

MONTHLY WEATHER REVIEW,

APRIL, 1881.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to May 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 136 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 183 monthly journals and 177 monthly means from the former, and 15 monthly means from the latter; reports from 5 Sunset stations; 220 monthly registers from Voluntary Observers; 64 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from the local Weather Services of Iowa, Nebraska and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The distribution of mean atmospheric pressure over the United States and Canada for the month of April, 1881, is shown by isobaric lines (in black) upon chart No. II. The region of lowest pressure remains about stationary over New England and the Maritime Provinces, but with barometric readings somewhat lower over the latter section than for any previous April since 1874. The regions of highest pressure occupy the Eastern Gulf coast and the Northern Pacific coast region. Compared with April, 1880, the distribution of pressure is about the same, except that the area of high is less marked and the area of low more confined. The latter, extending westward to the Missouri valley in April, 1880, is entirely superseded in the present month by an increase in the extreme of +0.2 inch, and over the Lake region of +0.12 inch.

Departures from the Normal Values for the Month.—Throughout the interior of the country the pressure is everywhere above the normal, being most marked in the Upper Mississippi and Missouri valleys and in the Middle Slope, where the departure varies from +0.06 at St. Louis, La Crosse, St. Paul and Dodge City to +0.1 at Bismarck and +0.12 at Yankton. The deficiency of pressure for the month coincides with the regions of greatest departure from the normal, viz.: in the Middle Atlantic and New England States and particularly along their coasts. Departures vary in the interior from -0.03 at Lynchburg and Washington to -0.07 at Burlington, Vt., and -0.08 at Philadelphia; from -0.04 at Cape Henry and Cape May to -0.14 at Portland and on summit of Mt. Washington, and -0.17 at Eastport. Throughout the Pacific States the pressure is below the normal, ranging from -0.04 at Portland to -0.07 at San Diego and -0.12 at San Francisco. On summit of Pike's Peak the departure is -0.11. The line of no change is not continuous, only three stations in extreme parts of the country, viz: Punta Rassa, Jacksonville and St. Vincent, reporting a normal condition.

Barometric Ranges.—The range of pressure during the month has varied in the extremes from 0.25 inch at San Diego to 1.37 inches at Eastport, and 1.38 inches at Ft. Buford. Ranges of 1.00 and above were reported from the following stations: New York City and Albany, 1.00; Ft. Sill, 1.01; Henrietta, Tex., and Burlington, Vt., 1.02; North Platte, 1.03; Springfield, Mass., and Moorhead, Minn., 1.05; New London, 1.06; Ft. Gibson, 1.07; Kittyhawk and Yankton, 1.08;

Thatcher's Island, 1.1; Ft. Elliott, 1.12; New Shoreham, 1.13; Hatteras, 1.15; St. Vincent, 1.16; New Haven and Boston, 1.17; Dodge City, 1.18; Portland, Me., 1.2; Newport, 1.21; Mt. Washington, 1.22; Wood's Holl, 1.32. In general the range has been greatest from Texas northeastward to New England, the latter district being the only one where the range at every station was above 1.00 inch. Throughout the country, except from Texas directly northward, the range increases with the latitude. As compared with past months, there has been a marked increase of range over the Florida Peninsula, varying from 0.11 to 0.17 inch. Along the southern boundary of the country the range increases from the southwestern and southeastern extremes (California and Florida) inward to the maximum in Texas, while over the northern boundary two maxima were reached, one in New England and the other in the extreme Northwest.

Areas of High Barometer.—Five such areas for the month of April have been sufficiently marked to merit a brief description, though none have exercised any special influence over the climatic conditions of the country. The minimum temperatures of the month in the interior of the country, occurring on the 1st and 2nd, are associated with high-area No. I. The minimum temperatures in the Middle States and New England, occurring on the 5th, 6th and 7th, are associated with a great depression then central over the Gulf of St. Lawrence, and extending into the districts named. A deficiency of both pressure and temperature was reported from New England and the Middle States.

No. I.—This is a continuation of high area No. II, described in the March REVIEW. At the morning report of the 1st the highest pressure extended from Manitoba to Indian Territory, the highest reading being at Moorhead, Minn., 30.58. During the day the high area moved southward, and on the 2nd it extended over the Gulf States, with diminishing pressure. In connection with this area the minimum temperatures for the month were reported, on the 1st, in Manitoba, Missouri, Wisconsin, Illinois, Indiana, the Ohio valley, Indian Territory, and on the 2nd, in Tennessee, the Gulf and South Atlantic States. The two lowest temperatures were at St. Vincent, -14° and Moorhead, -13° .

No. II.—During the movement of high area No. I, to the south on the 1st and 2d, the pressure, although diminishing, remained above the normal in Dakota and Manitoba, but on the 2d a marked rise took place in the Saskatchewan valley, and on the 3d the high area extended from Montana and Dakota to Texas, the highest readings being reported from the Missouri valley. On the 4th the highest barometers were reported from the Southwest, but on the ensuing day this area ceased to continue as a high pressure. In connection with this high area a maximum velocity of 51 miles from the northeast was reported from Indianola.

No. III.—On the 7th and 8th, after the passage of low area No. I, to the eastward, there was a great and general rise in pressure west of the Mississippi River. On the 8th the highest barometer extended from Manitoba to Indian Territory. On the 9th the highest pressure was in the Lower Missouri valley, but the area of high barometer extended to the Gulf. On the 10th the high area was divided by the approach of low barometer No. II, then moving over New Mexico and Northern Texas, one portion of the high area moving over the Gulf States and disappearing on the 11th, the other, remaining quite persistently over Manitoba and Dakota on the 10th and 11th, moved on the 12th, to the south, becoming central in western Texas, where, at the midnight report, the pressure was generally 0.4 inches above the normal. On the 13th the high pressure continued the movement to the south, the highest readings being reported from the valley of the Rio Grande. Cautionary Off-shore Signals displayed at Indianola were justified by a maximum velocity of 47, N.

No. IV.—On the 18th there was a decided rise in pressure over the Northwest and Lake region. On the 19th the highest barometer was transferred to the valley of the St. Lawrence. On the 26th and 27th a belt of high pressure extended north of the 40th parallel and west to the Rocky Mountains. On the 22nd the barometer was generally above the normal east of the Mississippi river. On the 23rd the highest barometer was transferred to the Middle Atlantic coast, where the pressure was in general more than 0.3 inches above the normal. On the 24th the high area moved slowly to the south, disappearing on the 25th before the advance of low area No. VI, moving over the Northwest and entering the Upper Lake region.

No. V.—On the 27th there was a sharp rise in pressure in Oregon and Washington Territory, the barometer averaging at the end of the day nearly 0.3 inches above the normal. On the 28th the high area extended over the Rocky Mountains and thence east to the Upper Mississippi valley. On the 29th the high area moved into the Lake region, with the pressure averaging 0.3 inches above the normal. On the 30th the high area advanced over the Lower Lakes, St. Lawrence valley and the Middle States, the pressure being generally 0.4 inches above the normal.

Areas of Low Barometer.—Seven such areas are charted for the month of April, 1881. None are traced from the Pacific coast. Nos. II, III and IV are specially interesting, because No. III was a secondary development of No. II, and No. IV a secondary development of No. III. Of the storms of the month the only one showing great energy was No. IV. Low area No. X, of

the March REVIEW, was traced to Nova Scotia on the last day of that month. The pressure remained below the normal in that region and nearly stationary in position until the 10th, the lowest reported reading being at Chatham at the morning observation of the 4th, 29.05, or 0.8 inch below the normal. In the meantime, low area No. I, in its march to the eastward, skirted the border of this depression, but did not unite with it within the limits of our charts.

No. I.—On the 5th the pressure west of the 100th meridian was generally below the normal, with the lowest barometer in Utah. On the 6th the depression moved, as charted, into southern Kansas, the lowest pressure at the midnight report being at Dodge City, 0.42 inch below the normal. On the 7th the storm centre advanced in an easterly track over Arkansas. At the centre of depression the barometer remained during the day between 0.4 and 0.45 inch below the normal. The following heavy rain-falls were reported for the day: Nashville, 1.75 inches; Memphis, 2.18; Montgomery, 1.43; St. Louis, 2.62. On the 8th the low area proceeded with diminishing energy eastward over Tennessee and North Carolina. On this day the heaviest rain-falls were: Savannah, 1.62 inches; Augusta, 2.15; Charleston, 1.48; Smithville, 1.97; Norfolk, 1.05; Cape Henry, 1.4. Cautionary Signals were ordered in advance of this storm, on the 5th at Indianola and Galveston, on the 7th, from Hatteras to Sandy Hook, and on the 8th from Jacksonville to Wilmington. From Smithville to Chincoteague these were justified by the following maximum velocities: Smithville, 28, E.; Macon, 30, SE.; Hatteras, 30, SE.; Kittyhawk, 31, E.; Cape Henry, 37, NE.; Chincoteague, 35, NE. The general track of this storm was slightly to the south of east. During its progress over the country an area of low barometer was central in Nova Scotia, and this area showed the tendency, before noted in the March REVIEW, to skirt the edge of the greater depression, and not to unite with it.

Nos. II, III and IV.—These three depressions should be described together, as No. III was a secondary development of No. II, and No. IV a secondary development of No. III. No. II.—On the 16th there was a considerable decrease in pressure in northwestern Texas and Indian Territory, showing the development of a low area in that region, which, at the midnight report, was located as indicated on the chart. On the 11th it pursued a northeasterly track over Arkansas and Missouri. The precipitation thus far, was confined to the northeast quadrant of the depression. On the 12th, at the morning report, the centre of low area had moved near Louisville, when the pressure, 29.62, was 0.34 inch below the normal. At the morning report the pressure in Nova Scotia was below the normal, the isobar of 29.8 enclosing Chatham, Halifax and Sydney; in the United States the isobar of 29.8 included the Ohio valley and Lake Erie. The low areas above referred to were divided by a belt extending from northwestern New York to Rhode Island, where the pressure was 30.00; the barometric gradient was slight and the meteorological conditions were not favorable to the development of storm energy. During the day area No. II was filled up by inflowing air. In the meantime, during the passage of No. II to the eastward, the barometer had remained below the normal and falling in Texas, and at the a.m. report of the 12th, the circulation of the winds indicated the formation of a new and independent centre of depression in northern Texas and Indian Ty., which, during the day extended northeastward into Tennessee and the Ohio valley. On this day the following great falls in temperature for the preceding twenty-four hours were reported: Ft. Elliott, 28°; Ft. Sill, 46°; Ft. Gibson, 37°; Concho, 31°; Stockton, 26°; Dennison, 29°; Little Rock, 22°; Memphis, 26°; Cairo, 25°; St. Louis, 21°. On the 13th, with diminishing energy, the storm centre passed off the Middle Atlantic coast. On this day the cold wave, before noticed, moved to the southeastward, the temperature falling 20° at Louisville and Knoxville, 21° at Nashville, 23° at Chattanooga, 25° at Memphis, 26° at Vicksburg, 27° at Shreveport and 23° at Montgomery.

No. IV.—On the 13th, during the passage of No. III over the Middle Atlantic States, the barometer remained low and falling in Georgia and the other South Atlantic States, accompanying the development of a secondary depression No. IV, which is charted on the afternoon of that day as central in Northern Georgia. At midnight the centre of the depression had advanced into South Carolina. On the 14th the storm centre, passing beyond the coast, moved with an extraordinary increase of energy in a track nearly parallel to the coast; the lowest barometer was reported from Hatteras, 29.24, or 0.7 inch below the normal. The following maximum wind velocities were reported during the day from the North Carolina coast: Hatteras, 60, N.; Kittyhawk, 76, NE. The following heavy rain-falls occurred during the day: Wilmington, 1.37 inches; Smithville, 1.67; Macon, 3.04; Hatteras, 4.83; Kittyhawk, 2.77. On the 15th, with a great development of energy, the storm pursued a northeasterly track as charted; at Eastport, at the p. m. report, the barometer was 28.81 or 1.05 inches below the normal. At the same report at Yarmouth, the pressure was 0.1 lower, or 28.71. The decrease in pressure for sixteen hours at Eastport was 0.92 inch, and at Yarmouth, 0.95 inch. On the 16th, the storm centre disappeared beyond the Gulf of St. Lawrence. For these storms, in advance of low area No. II, Cautionary Signals were displayed on the 11th along the Atlantic coast from Hatteras to New York, and on the Lakes from Buffalo to Milwaukee. The following maximum velocities were reported: Hatteras, 38, S.; Kittyhawk, 30, SW.; Cape Henry, 29, S.; Norfolk, 28, SW.; Chincoteague, 32, S.; Delaware Breakwater, 36, SW.; Cape May, 28, S.; Sandy Hook, 33, E.; Sandusky, 32, NE.; Toledo, 29, N. The Cautionary Off-shore Signal dis-

played on the 12th at Indianola was justified by a maximum velocity of 47, N. In advance of low area No. III, Cautionary Signals were displayed on the 14th from New Haven to Boston, which were only justified at Thatcher's Island and Boston. In no part of its course did depression No. II exhibit any special energy. In advance of low area No. IV, Cautionary Signals were displayed on the 14th from Cape Henry to Eastport, and Cautionary Off-shore Signals from Savannah to Macon; during the storm, Cautionary Signals were changed to Cautionary Off-shore Signals from Cape Henry to Portland. The following are the maximum velocities reported: Cape Henry, 52, N.; Norfolk, 35, N.; Chincoteague, 39, NW.; Delaware Breakwater, 45, N.; Cape May, 43, NW.; Atlantic City, 27, NE.; Barnegat, 40, N.; Sandy Hook, 38, NE. and 40, NW.; New Haven, 26, N.; New Shoreham, 60, NE.; Newport, 30, NW.; Wood's Holl, 36, NW.; Boston, 34, NE.; Thatcher's Island, 55, NE.; Portland, 35, NE.; Eastport, 52, NE.; Savannah, 33, NW.; Smithville, 28, N.; Macon, 52, N.

No. V.—On the 14th, while low area No. IV was pursuing its course along the Atlantic coast, a depression of slight energy, moving in a southeasterly track from Manitoba, entered the Mississippi valley; it was accompanied by light rains in its northwest quadrant, and after the morning report of the 15th ceased to exist as an independent depression.

No. VI.—On the 24th, a depression moving from the Saskatchewan valley, advanced in a southeasterly track over Minnesota. On the 25th the low area moved over Wisconsin and Michigan. On the 26th the centre passed over the St. Lawrence valley and New England. At no point of its track did it exhibit special energy and the rain-fall accompanying it, while general, was light. The only signal displayed for this storm was at Milwaukee, which was justified by a maximum velocity of 28, NW.

No. VII.—The circulation of the winds and the fall and rise of the barometer, showed the passage of a centre of depression to the eastward on the 26th and 27th, as charted. At no time was the centre of low area within the limits of the United States. No signals were displayed for this storm, and at no time did it exhibit special energy within the limits of the chart.

INTERNATIONAL METEOROLOGY.

Two international charts, Nos. V and VI, accompany the present REVIEW. The former, prepared for the month of May, 1877, is published in accordance with an explanation given in the leading paragraph under *International Meteorology* in the January, 1881, REVIEW; the latter, which has not appeared since December, 1880, owing in part to a delay in the publication of the May, 1879, number of the "Monatliche Ubersicht der Witterung" of the "Deutsche Seewarte," has now been provided for the month of May, 1879, and will make continuous the series of chart No. VI begun in October, 1877, the last of which was published for the month of April, 1879, in the December, 1880, REVIEW.

Chart No. IV, will hereafter be discontinued, as it is considered more practical and satisfactory, to study the development and progress of areas of low barometer, based upon later and therefore a more complete collection of ocean and land data, as exemplified in the preparation of chart No. VI, by which it will be replaced. The data for chart No. IV must necessarily be meagre and imperfect, as logs of vessels cannot be examined for the current month, neither can the land reports from stations in Europe and elsewhere over the Eastern Hemisphere, be received in time to make the study of storms as attempted on this chart of much value.

Chart No. V, shows the mean pressure, temperature, wind force and the prevailing direction of the wind at 7.35 a. m., Washington, or 0.43 p. m., Greenwich, mean time, for the month of May, 1877, over the Northern, and at certain isolated stations in the Southern Hemisphere. The Atlantic area of low pressure, which in January, 1877, covered the region beyond latitude 55° N., and between longitude 10° and 50° W., passed slowly southeastward, entering continental Europe over the British Isles and the North Sea, reaching the southern portion of Russia and southeastern Austria, where it remained nearly stationary during May, 1877. The lowest pressures of the month were reported from the following stations situated within the low area above named: Hermannstadt, 29.75 (755.6); Kieff, 29.76 (756.0); Lugan, 29.77 (756.3). A second area of low pressure covers the Canadian Maritime Provinces and a portion of the Atlantic north of latitude 50°, the pressures at Heart's Content, Newfoundland, and Godthaab, Greenland, being 29.80 (757.0) and 29.98 (761.6), respectively.. The highest monthly mean pressure, 30.10 (764.6), was reported from the following stations: York Factory, Funchall, Kingston, Jamaica and the City of Mexico. Other regions of comparatively high pressure were reported as follows: Honolulu, 30.08 (764.1); Toronto and Kingston, Canada, and Angra, 30.06 (763.5); Wilmington, N. C., and Batavia, 30.05 (763.3), and Stykkisholm, 30.04 (763.1). These pressures give a monthly barometric range of only 0.35 inch, which exhibits a steady decrease since the maximum of 1.28 in January. The regions of greatest cold were found in the neighborhood of the following stations, as indicated by the accompanying thermometric readings given in Fahrenheit's scale: Fort St. Michaels, 34°; Nikolaievsk, on the Amoor, 36°; Godthaab, 37°, and Haparanda, 39°. The prevailing direction of the wind was westerly along the Pacific coast of North America, and from

northeast to southeast in the interior; along the European coast from *southeast to southwest*, and over the Continent and in Asia from *northeast to northwest*; along the Mediterranean Sea variable, with a tendency to *southerly*. In comparison with the preceding month, few changes of importance have occurred. The variation of pressure, particularly over the Canadian Maritime Provinces, has been considerable, ranging from -0.1 to -0.16 inch. The decrease elsewhere is indicated as follows: At Godthaab, -0.08 inch; Bergen, Archangel, Barnaul and Tromso, -0.07 ; St. Petersburg and Pekin, -0.09 ; Brono, -0.1 ; Tashkent, Kuopio and Fort St. Michaels, -0.11 ; Christiana, -0.31 ; over the British Isles from -0.05 to -0.20 inch. The increase in pressure was not a marked feature of the month. There was slight evidence of it along the southern coast of the Mediterranean, over western and northern Asia and in Iceland. The temperature variations show a decided rise over the northern latitudes, as follows: In Siberia and Russia, from 10° to 20° ; in Europe, 5° to 15° ; along the northern boundary of the United States and at York Factory, Hudson's Bay Territory, from 15° to 28° . Compared with May, 1877, the month of May, 1878 has but one area of low pressure, which occupies a decidedly different position, covering the ocean to the northwest of the British Isles, with barometric readings 0.25 inch lower than for the low areas of May, 1877. The pressure is generally higher over the central portions of the United States, but considerably lower in the vicinity of Hudson's Bay. Along the Pacific coast the pressure remains about the same. Over Europe the isobar of 29.9 has moved from 15° to 20° farther to the north, while that of 29.8, expanded from its narrowed isolation north of the Black Sea, stretches from central Siberia westward to the North Atlantic and northward to Greenland. Over Iceland there is a fall of 0.28 inch, but only a slight change of -0.04 at Godthaab, Greenland. Along the eastern coast of Asia the fall has been from 0.05 to 0.15 inch. The change in temperature has also been quite marked, particularly in the vicinity of Hudson's Bay, where at York Factory there is a fall of $17^{\circ}.7$. The following stations show a lower mean temperature for 1878: Fort St. Michaels, $-8^{\circ}.5$; Godthaab, $-2^{\circ}.0$; Stykkisholm, $-2^{\circ}.0$; Nikolaievsk, on the Amoor, $-3^{\circ}.3$; Vladivostock, $-1^{\circ}.2$. Over Europe and Asia the temperature is considerably higher for 1878, but over the United States the reverse prevails with marked emphasis, particularly west of the 100th meridian, where the isotherm of 40° extends southward to San'a Fé, which in 1877 reported a mean temperature of $54^{\circ}.4$.

Chart No. VI.—Upon this chart are traced the paths of 30 of the principal storm areas of the Northern Hemisphere during the month of May, 1879. Of these, 13 are located over North America, 6 over Europe, 1 in Siberia, 3 over Hindooostan, 1 in China, 1 over the China and Japan Seas and the remainder (5) over either the North Atlantic or North Pacific Oceans. The storms of North America are, with but one exception, confined almost entirely to the boundaries of the United States; four, Nos. IV, VIII, XVIII and XXIII appear to have originated on the Pacific coast north of San Francisco and passed in an easterly direction over the country north of latitude 40° . Only two of the above reached the Atlantic, one of which, No. XXIII, after leaving the Gulf of St. Lawrence, passed north-northeast to the western coast of Greenland, and thence nearly across that country in an easterly track. The remaining two, Nos. VIII and XVIII, were lost sight of in the region between Manitoba and Hudson's Bay. Three, Nos. XIV, XXI and XXIX, first appeared in the Middle and Northern Plateau regions, and passing thence eastward, the latter disappeared north of Canada. No. XIV, continuing its course, passed from the Lower St. Lawrence valley northeastward over Labrador, thence in an easterly direction beyond the southern point of Greenland, turning again to the northeast near the 40th meridian and passing to the north of Iceland. During the passage of this storm the barometer at Godthaab, though quite low, gave evidence of but slight change, and for five days the wind shifted alternately from north to west, while at Stykkisholm, Iceland, the lowest pressure of the month, 28.97 (wind SSE., gale), occurred on the 20th as the storm-centre lay to the north-northwest. No. XXI, after leaving the Gulf of St. Lawrence, passed northeastward across the southern portion of Greenland, southeastward over Iceland and Scotland, and thence eastward over the North Sea, disappearing in central Europe. At Godthaab, during the passage of this storm, the lowest pressure of the month, 29.38 (wind W., strong), was recorded on the 23rd. On the following day the barometer rose to 29.67 (wind SSW). At Stykkisholm the pressure fell decidedly, reaching its lowest point, 29.10 (wind W., gale), on the 24th, as the storm passed to the eastward. Four, Nos. IX, XXII, XXVI and XXX, appear to have originated in the Southeastern Rocky Mountain region. The last, No. XXX, reached southern Michigan on the 31st; its further course to the eastward will appear on the June chart in the next REVIEW. No. XXVI, after reaching the Lower Lake region, disappeared to the north of Canada. No. IX, passed southeastward down the Rio Grande valley, reaching the Gulf of Mexico on the 6th, where further evidences of its course could not be found. No. XXII, after leaving the Gulf coast at New Orleans, is of very doubtful movement in the course, as indicated upon the chart. On the 22nd and 23rd, while the storm centre passed to the southeastward between the Yucatan Peninsula and Cuba, heavy easterly winds, increasing to gales, with rapidly falling barometer and rain, prevailed along the western coast of Florida and Cuba. On the 24th, $25.016'$, N. $80^{\circ}.0'$, W., steamship *Webster* experienced very heavy gales from east and north-northeast, with terrific high sea; lost sails and hove to for twelve hours. At Kingston, Jamaica, on the 24th and 25th, heavy northeast winds, with rain and falling pressure, prevailed. At San Juan, Porto Rico, 23rd, wind blowing a gale from the northeast, exceedingly stormy, sea very tempestuous; 24th,

wind still northeast, very strong, unusually heavy rain, sea very rough; 25th, rain still falling, but considerably abated, winds strong from the northeast; 26th, fair weather, wind east, light, after which the storm apparently passed to the northeastward south of the Bermudas, where, on the 26th, the wind changed from north (after blowing from that point for three days) to west, with rapidly rising pressure and clearing weather. No. V, appeared in New England on the 1st, and passed thence northeastward to the Gulf of St. Lawrence, from which point it turned southward to Nova Scotia, where it again changed to the northeast and disappeared beyond the eastern coast of Newfoundland. Of the storms located over Europe, two came from the ocean, one from south of the Mediterranean, while the remaining three appeared to originate over the mainland. No. VII, pursued quite a remarkable course, first appearing in about 55° , N., 25° , W. On the 3rd, in 59° , N. 23° , W. barometer fell to 29.95, overcast with rain. From this point it pursued a northeasterly course to the south of Iceland, reaching the coast of Norway by the 5th, barometer at Tromso, 29.37, a fall of 0.75 inch in past 48 hours. 6th, Archangel, 29.50, wind SSW.; St. Petersburg, 29.62, WSW.; Umea, 29.26, N.; Hernosand, 29.34, WNW.; Haparanda, 29.25, SW.; Stockholm, 29.44, W. 7th, St. Petersburg, 29.35, S.; Dorpat, 29.45, WSW.; Moscow, 29.46, S.; Umea, 29.40, NNW. 8th, Tromso, 29.24, SSW.; Brono, 29.38, WSW.; Haparanda, 29.46, S. 9th, Tromso, 29.24, E.; Brono, 29.38, SW.; Hernosand, 29.44, S. 10th, Brono, 29.42, SSW.; Bergen, 29.32, W.; Tromso, 29.41, NE. 11th, North Unst, 29.58, SSW., rain; Thorshavn, 29.85, NE., threatening; Thurso, 29.64, SW., rain; Holyhead, 29.95, WSW., rain; Nairn, 29.68, SW., threatening; on this day threatening weather and rain, with southerly winds, prevailed over the northern portion of the British Isles. 12th, Thorshavn, 29.76, W., rain; Vestervig, 29.98, SW., rain; Brono, 29.74, S. 13th, St. Petersburg, 29.70, S.; Dorpat, 29.68, NW., rain; Kieff, 29.54, SSW., rain; Nickolaiev, 29.77, SW., rain. No. XIX, first appeared over the southern portion of the British Isles and the North Sea on the 14th, where heavy rains and thunder-storms prevailed with northwest to southwest winds increasing to gales. On the 15th the storm centre passed northeastward beyond the Baltic, accompanied by heavy rains in northwestern Russia. On the 16th rain and threatening weather over the more northern portions of Russia, and from the 17th to the 21st over northern Siberia, where southerly winds prevailed. No. XXVII, apparently developed as a secondary depression over the English Channel and western France on the 28th, after the passage of area No. XXI, southeastward from the North Sea. On the 29th the storm moved northeastward over the British Isles, with heavy rains and thunder-storms, followed by southwest to northwest winds increasing to gales. On the 30th the centre of lowest pressure was transferred to the coast of Norway and thence eastward over Sweden into northern Russia. No. XV.—On the 10th low pressures, with occasionally heavy rains, prevailed over northern Italy and western Austria. On the 11th the lowest pressure was transferred to central Austria, with threatening weather and rain extending northward into Germany, lowest barometer, 29.41, wind, SE. at Lemburg; at Szathmar, barometer, 29.47, wind, SE., heavy rain. On the 12th and 13th the lowest pressure passed northeastward into central Russia, where further evidence of existence disappeared. No. VI, appeared to form on the 2nd, south of the Mediterranean and pass thence northeastward across southern Italy, where, from the 2nd to the 4th, occasionally heavy rains, with northeast to southeast winds, prevailed. There was no very marked change in the barometer; lowest pressure on the 2nd, 29.80, wind SE., at Cagliari; 3rd, 29.71, wind, ENE., at Leghorn. On the 4th and 5th the centre of lowest pressure was transferred to southwestern Russia, where it apparently filled up. No. XII, developed in southern Russia on the 8th (possibly a reappearance of No. VI) and, on the 9th and 10th, disappeared in the high pressure then prevailing over western Siberia. No. XXV, traversed southern Siberia; commencing its course near the mouth of the Volga river, it passed in an east-northeasterly direction and disappeared near the Baikal Sea in the district of Irkoutsk. Our charts, owing to want of sufficient data, give but partial evidence of the movement of this area. Nos. XX, XXIV and XXVIII, appearing over northern Hindooostan from the 16th to 31st, were due to the setting in of the spring monsoon. On the 16th heavy rains, with west to northwest winds, began along the western coast, with the lowest pressures prevailing over the northern districts. From this date to the 31st, the area of lowest pressure changed from west to east with great variability, and rain fell either in one district or another without intermission. On the 29th, at Deesa, terrific whirlwind, accompanied with heavy rain and much destruction to property; the centre of the area of lowest pressure at the time, appeared to be situated somewhat to the northeast. On the 30th heavy rain continued for 12 hours at Kuttack and Sibsigar, centre of lowest pressure to the northwest. No. XIII, probably appeared in central China on or about the 8th, and passed northeastward into the district of Mautchooria, where it disappeared on the 10th and 11th. On the 8th, barometer at Hong Kong 29.84, wind ESE., threatening; in 25° , N. 118° , E., barometer 30.00, wind SE., threatening; at Shanghai, barometer 29.88, wind SSE. 9th, Hong Kong, 29.84, SE.; in 25° , N. 118° , E., 29.92, SW.; Shanghai, 29.81, S., heavy rain. 10th, Hong Kong, 30.00, SSE.; in 25° , N. 118° , E., 29.87, SSE.; Shanghai, 29.66, SE., heavy rain. On the 11th the barometer rose at all the foregoing stations, with winds shifting to north and northwest. No. II passed northeastward over the China and Japan Seas from the 1st to the 4th. On the 1st at Shanghai, barometer 29.89, calm; on the east shore of the Island of Katsum, Japan, very boisterous weather. 2nd, Yeddo, 29.95, gloomy weather, wind southwest, strong gale. 3rd, near the Island of Formosa, 29.88, S.; Shanghai,

29.88, S., threatening; Yeddo, 29.80, calm, gloomy weather. 5th, Shanghai, 29.76, S., heavy gale; Yeddo, 29.75, calm, rain; in 35°, N. 160°, E., 29.72, SE., heavy gale, rough sea. No. X, appeared to develop in southeastern China on or about the 6th and passed northeastward over the ocean to the south and east of the Japan Isles, from thence northeastward over Behring's Sea to Alaska and eastward into British North America. On the 6th and 7th, very heavy rains, with northeast to northwest winds, prevailed along the south and east coasts of Japan; lowest pressure on the 7th at Yeddo, 29.50, wind NW., rain-fall 3.43 inches. On the 8th and 9th, as the storm passed to the eastward, clearing weather, with westerly winds, prevailed. On the 12th and 13th, as the centre of lowest pressure was approaching Alaska from Behring's Sea, snow and rain, with a SSE. wind, occurred at Ft. St. Michaels. 14th, Ft. St. Michaels, southeasterly gale all day, with snow, barometer 29.73; Unalaska, wind SE., heavy gale, rain-fall 1.07 inches, rising temperature. 15th, Ft. St. Michaels, high easterly gale, barometer 29.68; Unalaska, very heavy gales from SE., SW. and W., falling temperature, with light rain. 16th, Ft. St. Michaels, high easterly gale, barometer 29.24; Unalaska, strong west winds all day, rising temperature. 17th, Ft. St. Michaels, east to south gales, barometer 29.71; Unalaska, strong southeast wind all day, light rain, stationary temperature. 18th, Ft. St. Michaels, 30.08, strong SSE. wind; Unalaska, wind south all day, fresh, light rain and rising temperature. On the 19th wind changed to west, with clearing weather. No. XVII, probably made its first appearance in southern China on the 12th, and, on the 16th, moved northeastward over the China Sea; on the 17th and 18th over Japan Sea and Japan, and thereafter pursued an irregular easterly course to near the western coast of North America, between 40° and 50° north latitude, which locality it reached on the 30th, where it probably again gathered renewed energy and appeared on the Pacific coast of the United States as area No. III, in the June, 1879, REVIEW. The track of this storm is founded upon reports from stations in China and Japan, logs of vessels traversing the North Pacific ocean, and reports from Unalaska. No. III appeared as a slight depression over the Aleutian Islands on the 1st, and passed thence eastward across the Alaska Peninsula, reaching British North America on the 5th, where it disappeared in the high pressure then occupying the region north of Hudson's Bay. No. XI, developed off the South Carolina coast, on the 7th and 8th, in about latitude 30°, N., longitude 75°, W., and passed thence northeastward, disappearing on the 10th and 11th in a high-pressure area then prevailing to the southeast of Newfoundland. On the 8th schooner *McNeil*, in 31°, 21' N., 79°, 22' W., experienced violent E. to NE. gales and heavy cross-seas, lasting 48 hours. 9th, schooner *Nellie*, in about 32°, N., 75°, W., was struck by lightning and experienced very heavy seas. No. I appeared as a slight depression near latitude 35°, N., longitude 38°, W., where threatening and rainy weather, with rough seas, prevailed from the 1st to the 3rd. During the 4th and 5th the centre of depression moved southeastward, from latitude 35° to the African coast, followed over the Azores and Madeira Islands by rapidly rising pressure and westerly winds.

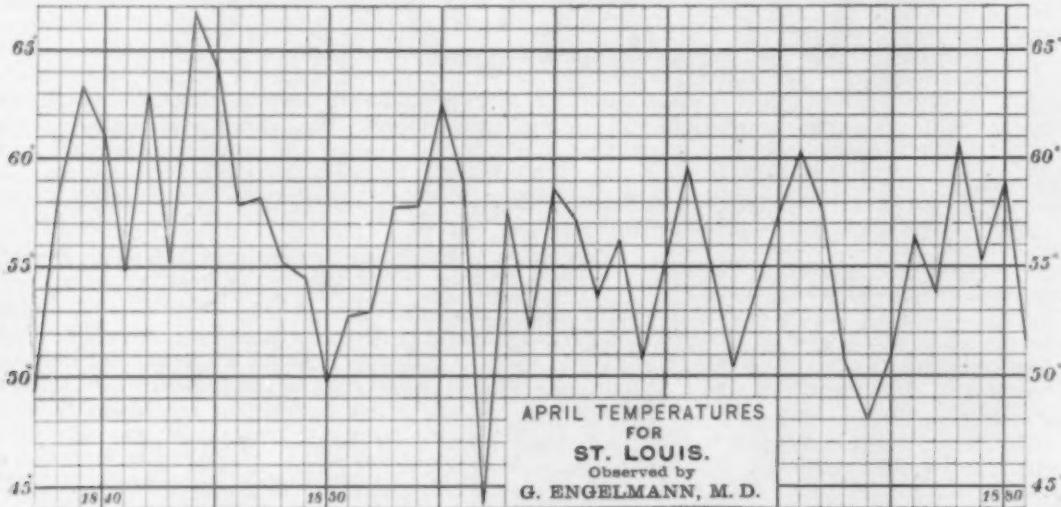
It is of interest to note in connection with the small number of storms crossing the Atlantic Ocean and their extreme northern latitude, the presence of an unusually high-pressure area over the North Atlantic Ocean between latitude 30° and 50° N. and longitude 25° and 45° W. The mean for the month in this region ranged from 30.23 to 30.38 and the temperature from 55° to 70°, while the prevailing winds were northeast to southeast south of latitude 40°, and southeast to southwest and northwest, to the northward of that parallel. From a record running back to October, 1877, no single month furnishes mean readings for this region of the North Atlantic to exceed 30.25, while the average of the highest mean readings for the 19 months, including April, 1879, was only 30.09. The average number of storms crossing the Atlantic north of parallel 40° for a period covering 17 months, between December, 1877, and April, 1879, was about 5, while May, 1879, presents barely 3. This places the month below the mean, but not lower than seems to be usual for this period of the year, as in May, 1878, only 2 storms were reported to have passed over the ocean from the main land of America. It is perhaps rather premature to make comparisons of this nature while the records of international storm charting are so meagre. Individual cases of very high barometric readings, as taken from the logs of vessels reported in the "Monatliche Uebersicht der Witterung" of the "Deutsche Seewarte," for May, 1879, are given as follows: 23rd, in 39°.5', N., 37°.6', W., 30.69; in 39°.4', N., 35°.0', W., 30.67; in 42°.5', N., 41°.9', W., 30.62. 24th, in 40°.9', N., 37°.5', W., 30.76; in 40°.2', N., 34°.6', W., 30.71; in 43°.2', N., 40°.1', W., 30.77; in 45°.5', N., 45°.4', W., 30.63; in 44°.1', N., 38°.7', W., 30.61; in 45°.1', N., 36°.9', W., 30.74. 25th, 42°.7', N., 37°.2', W., 30.81; in 42°.1', N., 34°.5', W., 30.77; in 44°.1', N., 38°.8', W., 30.77; 49°.6', N., 33°.1', W., 30.62; in 44°.4', N., 37°.8', W., 30.61; in 46°.5, N., 31°.5', W., 30.71. 26th, in 44°.1', N., 35°.8', W., 30.73; in 43°.2', N., 34°.3', W., 30.69; in 44°.8', N., 36°.7', W., 30.69; in 47°.3', N., 33°.5', W., 30.68. 27th, in 44°.7', N., 34°.2', W., 30.67; in 43°.7', N., 33°.4', W., 30.65; in 45°.5', N., 33°.9', W., 30.70; in 46°.8', N., 34°.0', W., 30.66.

TEMPERATURE OF THE AIR.

The mean temperature of the air for April, 1881, is shown by the isothermal lines (in red) on chart No. II. The table of mean and comparative temperatures in the right-hand corner of the chart, shows in the first column the average for the month throughout the various districts as deduced principally from observations taken at Signal Service stations. In the two remaining col-

umns are shown the means for the present month, and the departures of such means from the average for many years. West of the 100th meridian the temperature is everywhere above the normal, while in every district to the eastward it is below, except in the West Gulf States, where it is normal. The departures of excess range from +0.7 in the Southeastern Rocky Mountain Slope to +4.0 in the Northern Pacific Coast region, +5.9 at Salt Lake City and +6.5 on summit of Pike's Peak. Departures of deficiency range from -0.5 in New England and the Rio Grande valley to -3.4 in Minnesota and the South Atlantic States, and -5.2 on the summit of Mt. Washington.

Deviations from Mean Temperatures.—Under this heading departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the right-hand side of chart No. II. The following items of importance in connection with this subject are reported by voluntary observers: *Florida*: Houston, month remarkably cold. *Georgia*: Forsyth, severest weather in April since 1849. *Illinois*: Riley, mean temperature 5°.6 below mean of past 20 years; coldest April occurred in 1874. *Iowa*: Ft. Madison, month unusually cold and backward. Clinton, mean temperature slightly below the normal; first half of the month unusually cold. *Kansas*: Lawrence, mean temperature 1°.45 below mean of past 13 years; fruit trees began to bloom later than ever before recorded. Topeka, mean temperature considerably below the normal; on first ten days of the month temperature reached freezing point each day. Holton, mean temperature considerably below the normal; vegetation very backward. *Maine*: Gardiner, mean temperature 2° below that of past 45 years; month very cold. *Maryland*: Sandy Springs, mean temperature slightly below the normal; mean of first 20 days, 26° colder than the mean of the last 10 of the month. Fallston, mean temperature 1° below that of past 14 years. *Michigan*: Thornville, month very cold, temperature considerably below the normal; vegetation very backward. Litchfield, month very cold; vegetation backward. *Minnesota*: New Ulm, temperature considerably below the normal; month cold and very backward. *Missouri*: St. Louis,



"Missouri Weather Service" reports mean temperature 4°.4 below mean of past 45 years; eight times since 1837 mean temperature lower than that of present month; coldest April occurred in 1857, mean temperature 44°.1; warmest April occurred in 1844, mean temperature 66°.8; highest maximum 93° in 1837; lowest minimum 18° in 1857. The above diagram shows the curve of mean temperatures for April, as furnished by Prof. T. E. Nipher, of the "Missouri Weather Service." As compared with the observations taken at the Signal Service station in St. Louis during the past 10 years, the curves appear to be reliable. *Nebraska*: Howard, mean temperature, 6°.3 below that of past four years. *New Jersey*: Freehold, temperature considerably below the normal; vegetation very backward. *New York*: North Volney, mean temperature 2° below that of past 13 years; coldest April occurred in 1874, mean temperature 33°.6; warmest April occurred in 1878, mean temperature 50°.9; highest maximum 80° in 1881. Palermo, coldest April in past 28 years, except 1868, 1874 and 1875. Ardenia, temperature considerably below the normal; month unusually cold, especially the last half. Waterburg, mean temperature 0°.7 below that of past 10 years. *Ohio*: Cleveland, mean temperature 4°.6 below that of past 26 years; coldest April occurred in 1837, mean temperature 37°.8; warmest April occurred in 1878, mean temperature 53°.8. Little Mountain, temperature below the normal, month unusually cold and backward. Westerville, temperature below the normal, month unusually cold and blustering, especially the first half. North Lewisburg, mean temperature 6° below that of past 50 years; spring, three to four weeks later than usual. *Pennsylvania*: Wellsboro, month unprecedentedly cold, temperature considerably below

the normal; vegetation very backward and agricultural operations much delayed. *Texas*: Clarks-ville, month unusually cool; vegetation backward. *Washington Territory*: Bainbridge Island, mean temperature 3° above that for April, 1880. *Wisconsin*: Embarrass, temperature below the normal. *West Virginia*: Flemington, first half of month very cold; vegetation backward.

Table of Maximum and Minimum Temperatures for April, 1881.

State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.			State or Territory.	Signal Service.			U. S. Army Post Surgeons or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.		Station.	Max.	Min.	Station.	Max.	Min.
Alabama.....	Mobile.....	90°	.....	Auburn.....	27°	.....	Mississippi.....	Vicksburg.....	90°	31°	Neosho.....	95°	.....
Do.....	Montgomery.....	36°	.....	Maricopa.....	108°	.....	Missouri.....	St. Louis.....	87°	23°	Oregon.....	93°	.....
Arizona.....	Yuma.....	102°	.....	Fayetteville.....	17°	.....	Montana.....	Fort Keogh.....	90°	.....	Lincoln.....	87°	.....
Do.....	Prescott.....	26°	.....	Indio.....	105°	.....	Do.....	Fort Shaw.....	.....	-3°	Hot Springs.....	88°	.....
Arkansas.....	Little Rock.....	89°	29°	Summit.....	23°	.....	Nebraska.....	North Platte.....	82°	6°	Auburn.....	78°	.....
California.....	Los Angeles.....	94°	.....	Ft. Lyon.....	80°	16°	Nevada.....	Omaha.....	79°	20°	Grafton.....	12°	.....
Do.....	Campo.....	28°	.....	Do.....	Winnemucca.....	.....	N. Hampshire.....	and Pioche.....	42°	-17°	Vineyard.....	88°	.....
Colorado.....	Denver.....	84°	.....	Do.....	M. Washington.....	.....	M. Washington.....	Do.....	Princeton.....	19°	.....	.....	.....
Do.....	Pike's Peak.....	-3°	.....	Do.....	New Jersey.....	75°	.....	Do.....	Ft. Union.....	5°	.....	.....	.....
Connecticut.....	New Haven.....	73°	22°	Southington.....	79°	19°	Do.....	Sandy Hook.....	75°	.....	.....	.....	.....
Dakota.....	Ft. Buford.....	92°	.....	Pembina.....	-12°	.....	Do.....	Atlantic City.....	22°	.....	.....	.....	.....
Do.....	Yankton.....	-3°	.....	Ft. Barrancas.....	94°	27°	Do.....	La Mesilla.....	98°	.....	.....	.....	.....
Delaware.....	Breakwater.....	73°	25°	Forsyth and.....	.....	.....	Do.....	Sante Fe.....	22°	.....	.....	.....	.....
Dist. Columbia.....	Washington.....	87°	24°	Quitman.....	90°	.....	Do.....	Albany.....	80°	.....	.....	.....	.....
Florida.....	Key West.....	91°	.....	Logan.....	.....	.....	Do.....	Buffalo.....	11°	.....	.....	.....	.....
Do.....	Pensacola.....	34°	.....	Crésc...e.....	84°	.....	Do.....	Wilmington.....	86°	.....	Weldon.....	89°	.....
Georgia.....	Augusta.....	80°	.....	Vail.....	0°	.....	Do.....	Charlotte.....	28°	.....	Highlands.....	10°	.....
Do.....	Atlanta.....	25°	.....	.....	.....	.....	Do.....	Columbus.....	83°	.....	College Hill.....	88°	.....
Iowa.....	Des Moines.....	81°	29°	.....	.....	.....	Do.....	Sandusky.....	14°	.....	Bellefontaine.....	5°	.....
Do.....	56°	.....	.....	.....	.....	.....	Do.....	Umatilla.....	82°	.....	.....	.....	.....
Do.....	Boise City.....	78°	.....	.....	.....	.....	Do.....	Roseburg.....	34°	.....	.....	.....	.....
Idaho.....	Eagle Rock.....	19°	.....	Anna.....	87°	.....	Do.....	Pittsburg.....	86°	17°	Milton.....	87°	.....
Illinois.....	Cairo.....	83°	.....	Elmira.....	10°	.....	Do.....	.....	.....	Wellsboro.....	10°	.....
Do.....	Chicago.....	17°	.....	Logansport.....	86°	.....	Do.....	Newport.....	61°	23°	Aiken.....	87°	26°
Indiana.....	Indianapolis.....	78°	24°	Wabash.....	17°	.....	Do.....	Charles-ton.....	81°	32°	Ashwood.....	22°	.....
Do.....	.....	.....	.....	.....	.....	.....	Do.....	Memphis.....	87°	.....	.....	.....	.....
Indian Ty.....	Fort Sill.....	94°	.....	.....	.....	.....	Do.....	Knoxville.....	24°	.....	.....	.....	.....
Do.....	Fort Gibson.....	26°	.....	.....	.....	.....	Do.....	Rio Grande.....	102°	.....	Ft. Elliott.....	20°	.....
Kansas.....	Dodge City.....	91°	13°	Yates' Centre and Topeka.....	70°	.....	Do.....	Denison.....	27°	.....	Ogden.....	87°	.....
Do.....	Leavenworth.....	13°	.....	Bowl'g Green.....	87°	21°	Do.....	Utah.....	73°	36°	Conville.....	18°	.....
Kentucky.....	Louisville.....	82°	23°	.....	.....	.....	Do.....	.....	.....	Newport.....	8°	.....
Louisiana.....	Shreveport.....	91°	32°	.....	.....	.....	Do.....	Vermont.....	73°	11°	Accotink.....	96°	.....
Maine.....	Portland.....	78°	.....	.....	.....	.....	Do.....	Burlington.....	89°	.....	Wytheville.....	17°	.....
Do.....	Eastport.....	11°	.....	.....	.....	.....	Do.....	Lynchburg.....	25°	.....	.....	.....	.....
Maryland.....	Baltimore.....	84°	25°	.....	.....	.....	Do.....	Washington Ty	83°	.....	.....	.....	.....
Massachusetts.....	Boston.....	80°	.....	Emmittsburg.....	86°	19°	Do.....	Dayton.....	23°	.....	.....	.....	.....
Do.....	Thatcher's I'd.....	18°	.....	South Lee.....	10°	.....	Do.....	Do.....	.....	.....	.....	.....	.....
Michigan.....	Port Huron.....	78°	.....	Hath-a.....	10°	.....	Do.....	Do.....	.....	.....	.....	.....	.....
Do.....	Alpena.....	-2°	.....	Lansing.....	84°	.....	Do.....	Do.....	.....	.....	.....	.....	.....
Minnesota.....	St. Paul.....	78°	.....	New Ulm.....	84°	.....	Do.....	Do.....	.....	.....	.....	.....	.....
Do.....	St. Vincent.....	-14°	.....	.....	.....	.....	Do.....	Do.....	.....	.....	.....	.....	.....

Ranges of Temperature at Signal Service Stations.—Monthly ranges in general varied from 50° to 75° over the country east of the Rocky Mountains, and from 35° to 55° to the westward of that region. Ranges less than 50° occurred in the following districts: Northern Plateau, Northern Pacific coast, Middle Pacific coast, Southern Pacific coast, Middle Plateau and along the Gulf and portions of the South Atlantic, Middle Atlantic and New England coasts. The *smallest ranges* were: San Francisco, 28°; Key West, 30°; San Diego, 31°; Wood's Holl and New Shoreham, 33°; Shakespeare, N. M., and Galveston, 35°; Portland, Or., Sacramento, Punta Rassa and Newport, 40°. The *largest* were: St. Vincent, 87°; Moorhead, 86°; Ft. Buford, 84°; Yankton, 82°; Bismarck, 79°; Dodge City, 78°; Ft. Gibson, 73°; Omaha, La Crosse, Duluth and Ft. Keogh, 72°; Deadwood, Ft. Bennett and Marquette, 71°; Ft. Elliott and Des Moines, 70°. The *daily ranges* varied in the different districts as follows: New England, from 21° at New Shoreham to 36° at Boston, Springfield and Portland; Middle States, 18° at Cape May to 32° at Albany, 35° at Washington and 37° at Norfolk; South Atlantic States, 24° at Hatteras to 31° at Charlotte and 34° at Smithville; Eastern Gulf States, 17° at Key West to 29° at Vicksburg and 32° at Montgomery; Western Gulf States, 19° at Galveston to 42° at Ft. Gibson, 43° at Denison and Corsicana and 46° at Mason; Ohio valley and Tennessee, 26° at Cincinnati to 37° at Chattanooga, 39° at Nashville and 40° at Pittsburgh; Lower Lake region, 20° at Erie to 27° at Rochester and Oswego and 30° at Detroit; Upper Lake region, 27° at Chicago to 34° at Port Huron, 36° at Duluth and 39° at Alpena; Upper Mississippi valley, 23° at La Crosse to 34° at Des Moines, 35° at St. Louis and St. Paul and 38° at Dubuque; Missouri valley, 30° at Omaha to 32° at Yankton, 38° at Leavenworth and 39° at Ft. Bennett; Extreme Northwest, 35° at Moorhead to 36° at Bismarck, 37° at St. Vincent and 48° at Ft. Buford; Northern Slope, 41° at Deadwood to 44° at Ft. Custer and 46° at Ft. Keogh; Middle Slope, 26° on summit of Pike's Peak to 38° at Denver, 41° at Ft. Elliott and 48° at Dodge City; Southern Slope, 40° at Henrietta to 52° at Concho and 54° at Ft. Davis; Northern Plateau, 33° at Boise City to 36° at Umatilla, 41° at Eagle Rock and 44° at Dayton; Middle Plateau, 30° at Salt Lake City to 37° at Pioche and 47° at Winnemucca; Southern Plateau, 27° at Shakspeare to 48° at Tucson, 50° at Prescott and 55° at La Mesilla; North Pacific, 27° at

Portland to 32° at Roseburg and 34° at Olympia; Middle Pacific, 22° at San Francisco, to 26° at Sacramento and 31° at Red Bluff; South Pacific, 27° at San Diego to 36° at Visalia, 40° at Los Angeles and 50° at Campo.

Frosts were reported very frequently north of the 38th parallel and east of the 102nd meridian. South and westward of these boundaries they occurred in the various States on the following dates: *North Carolina*, 1st to 7th, 10th, 14th, 15th, 17th; *South Carolina*, 2nd, 5th, 6th; *Stateburg*, 2nd, 5th, killing blossoms and buds on low grounds; *Georgia*, 1st, 2nd, 5th; *Quitman*, 2nd, killing tender vegetation; *Florida*, 2nd, 3rd, 5th; *Alabama*, 2nd, 6th, 10th, 15th; *Green-Springs*, 2nd, killing vegetation; *Mississippi*, 2nd, 5th, 14th; *Tennessee*, 1st, 2nd, 4th, 5th, 10th, 14th, 16th, 17th; *Arkansas*, 1st, 2nd, 4th, 14th; *Louisiana*, 1st, 2nd, 5th, 14th; *Texas*, 1st, 4th, 12th, 13th, 14th; *Cleburne* and *San Antonio*, 14th, killing vegetation; *Indianola*, 14th, killing cotton plants and garden truck; *Clarksville*, 14th, very destructive to peaches, apples, pears and plums, early corn had to be replanted in many localities, oats badly damaged, and the young foliage of forest trees extensively destroyed; *New Mexico* and *Arizona*, 13th, 14th; *Colorado*, 4th, 9th, 15th, 17th; *Utah*, 8th, 13th, 23rd, 25th; *Nevada*, 11th, 12th, 24th; *Carson City*, 24th, killing fruit and vegetables; *California*, 7th, 8th, 11th; *Oregon*, 12th, 30th; *Umatilla*, 30th, slightly damaging fruit trees and grape vines; *Idaho*, 1st to 4th, 7th, 8th, 12th, 28th, 30th; *Montana*, 1st to 4th, 6th to 13th; 24th, 25th, 27th to 30th. *Washington Territory*, 8th, 12th, 23rd, 26th, 30th; *Dayton*, 30th, slight damage to vegetation, which is about a month in advance of the usual growth for this period.

PRECIPITATION.

The general distribution of rain-fall (including melted snow) for April, 1881, is shown on chart No. III from the reports of over 500 stations. From the table in the left-hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records (covering a period of many years) of Signal Service stations, and also a comparison of the present month with such averages. In general the rain-fall is considerably below the normal, only two remote and comparatively unimportant districts, viz: the Florida Peninsula and the Northern Pacific coast region, show the slightest excess. The most marked feature of this important subject for the month, is not so much the deficiency in any particular district, as that this deficiency is remarkably general, affecting in a striking manner those districts which are usually subject to heavy precipitation at this period of the year. As compared with the previous records of Signal Service observations for the month of April since 1874, no such wide-spread deficiency has ever been reported. The departures from normal are most marked, save two exceptions, over the northern sections of the country, the largest, -2.34, being reported from New England. There has been little if any variation from the accustomed diversity of rain-fall over the Rocky Mountain and Plateau districts, the largest amount, 4.64 inches, fell on the summit of Pike's Peak, while an entire absence of rain was reported from scattering stations in Arizona, California, Nevada and Utah.

In connection herewith the following notes from voluntary observers are of interest: *Riley*, Ill., monthly rain-fall 1.74 inches below mean of past 20 years; dryest month ever observed. *Lawrence*, Kans., rain-fall 1.91 below mean of past 13 years. *Gardiner*, Me., monthly rain-fall 1.82 below mean of past 45 years; dryest April occurred in 1844. *Sandy Springs*, Md., rain-fall remarkably small for April. *St. Louis*, the "Missouri Weather Service" reports monthly rain-fall considerably below the average. The "Nebraska Weather Service" reports 2.86 inches as an average for the whole State, which is more than three times as much as fell in April, 1880; rain-fall in western part of State exactly the average of 20 years, in the eastern part a little below the usual amount. *Contoocookville*, N. H., monthly rain-fall 2.00 inches below the normal; dryest April on record. *Grafton*, N. H., monthly rain-fall considerably below the normal; dryest April on record. *Palermo*, N. Y., dryest April in past 28 years, excepting 1879. *Waterburg*, N. Y., monthly rain-fall 1.19 below mean of past 19 years. *Argyle*, N. Y., monthly rain-fall considerably below the mean; crops suffering from drought. *Cleveland*, monthly rain-fall 0.82 below mean of past 26 years. *Mission House*, Wis., monthly rain-fall considerably below the average; month remarkable for the absence of the customary April rains.

Special Heavy Rains.—1st, *Wellsboro*, Pa., 3.16 inches. 4th, *Laredo*, 2.53. 7th, *St. Louis*, 2.62; *Auburn*, Ala., 2.75. 12th, *Wellsboro*, Pa., 3.26; *Green Springs*, Ala., 3.00. 14th, *Hatteras*, 4.83; *Fort Macon*, 3.04; *Kittyhawk*, 2.77; *Lincoln*, Neb., 3.00. 17th and 18th, *Battle Creek*, Mich., 3.00. 20th, *Brackettville*, 2.50. 20th and 21st, *Mason*, 2.60; *Henrietta*, 4.70. 21st, *Corsicana*, 3.30; *Melissa*, Tex., 3.00. 21st and 22nd, *Graham*, Tex., 3.36. 22nd, *Port Eads*, 6.29. 24th, *Mobile*, 5.34; *Pensacola*, 2.73; *Fort Barrancas*, Fla., 3.08. 25th, *Highlands*, N. C., 4.85. 25th and 26th, *Galveston*, 3.20.

Largest Monthly Rain-falls.—*Mobile*, 9.21 inches; *Elsworth*, N. C., 7.38; *Highlands*, N. C., 7.20; *Neah Bay*, Wash. Ty., 7.02; *Hatteras*, 6.88; *Franklin*, N. C., 6.70; *Bowling Green*, Ky., 6.09; *Cape Henry*, 6.03; *Quitman*, Ga., 5.90; *Memphis*, 5.74; *Ft. Barrancas*, Fla., 5.55; *Ft. Canby*, Wash. Ty., 5.51.

Smallest Monthly Rain-falls.—Summit, Chico and Indio, Cal., Tecoma, Nev., Ogden, Utah, and Maricopa and Benson, Ariz., none; Reno, Nev., 0.02 inch; Golconda, Nev., 0.03; Toano, Nev., 0.05; Anaheim, Cal., and Ft. Brown, Tex., 0.06; Solidad, Cal., and La Mesilla, N. M., 0.09; Ft. Benton, Mont., and Spiritwood, Dak., 0.10; Carson City, Nev., and camp near Presidio, Tex., 0.12; Ft. McDermitt, Nev., 0.16; Santa Maria, Tex., and Browns, Nev., 0.13; Wells, Nev., 0.17; Farmington and Mojave, Cal., 0.18; Elko, Nev., and Lunenburg, Vt., 0.20; Ft. Assinniboine, 0.21; El Paso, 0.22; Socorro, 0.23; Cornish, Me., 0.26; Friendship, N. Y., 0.27; Colton, Cal., 0.28; Ft. Lyon, 0.29; Ft. Totten, Dak., Plattsburg Barracks, N. Y., and Brownsville, Tex., 0.30; Merced and Newhall, Cal., 0.34; Otego, Nev., Ft. Shaw and Ft. Keogh, 0.35; Ft. Niagara, N. Y., 0.38; Ft. Bridger, Wy. T., 0.39; Ft. Lewis, Col., and Ft. Elliott, Tex., 0.40; Madison Barracks, N. Y., and Ft. Wingate, N. M., 0.42; Hot Springs, Nev., and Argyle, N. Y., 0.43; Salinas, Cal., Beowawe, Nev., and Escanaba, 0.44; Rapid City, Dak., Northport, Mich., and Ft. Wallace, Kan., 0.45; Los Angeles, Stockton and Ft. Custer, 0.46; Yates Centre, Kan., and St. Paul, 0.47; Ravenna, Cal., and Silver City, 0.48; Truckee, Cal., 0.49; Brighton, Alta, San Fernando and Tehachapi, Cal., Denver and Hermosa, Col., Hector, N. Y., and Neillsville, Wis., 0.50.

Rainy Days.—The number of days on which rain or snow has fallen varies as follows: New England, 7 to 19; Middle Atlantic States, 7 to 17; South Atlantic States, 5 to 15; Eastern Gulf States, 5 to 9; Western Gulf States, 2 to 12; Ohio valley and Tennessee, 10 to 19; Lower Lake region, 7 to 14; Upper Lake region, 4 to 15; Upper Mississippi valley, 10 to 20; Missouri valley, 3 to 12; Red River of the North valley, 8 to 13; Texas, 4 to 12; Rocky Mountains, 5 to 15; Middle Plateau, 4 to 10; Southern Plateau, 1 to 9; California, 3 to 10; Oregon, 5 to 18; Washington Territory, 14 to 19.

Cloudy Days.—The number varied in New England from 2 to 10; Middle Atlantic States, 5 to 12; South Atlantic States, 2 to 13; Eastern Gulf States, 1 to 9; Western Gulf States, 5 to 9; Ohio valley and Tennessee, 7 to 16; Lower Lake region, 6 to 10; Upper Lake region, 2 to 9; Upper Mississippi valley, 4 to 12; Missouri valley, 6 to 14; Red River of the North valley, 3 to 16; Texas, 1 to 10; Rocky Mountains, 5 to 10; Middle Plateau, 3 to 11; Southern Plateau, 1 to 6; California, 1 to 13; Oregon, 11 to 19; Washington Territory 13 to 15.

Snow.—The extreme southern latitude at which snow has fallen is a remarkable feature of the month. Between the 77th and 107th meridians no less than seven localities report snow as far south as latitude 35° between the 1st and 13th, and, in two instances, below that parallel. In the various northern districts it fell on the following dates: *New England*.—1st, 2nd, 5th, to 7th, 11th to 19th, 22d, 24th, 25th, 26th, 29th, 30th. *Middle Atlantic States*.—1st to 8th, 11th to 13th. *North Carolina*.—Charlotte, 1st, 4th. *Tennessee*.—1st, 4th, 5th. *Ohio Valley*.—1st to 6th, 9th, 11th, 13th, 15th. *Lower Lake Region*.—1st to 8th, 11th to 15th. *Upper Lake Region*.—1st to 6th, 10th to 16th, 28th, 29th. *Upper Mississippi Valley*.—1st to 4th, 7th to 15th, 24th to 26th. *Missouri Valley*.—2d to 12th. *Valley of the Red River of the North*.—1st to 3rd, 8th, 12th to 15th. *Northern Rocky Mountain Slope*.—1st to 12th, 23d to 25th. *Rocky Mountains*.—5th to 14th, 20th to 23rd. *Northern Plateau*.—5th to 11th, 12th, 16th, 17th. *Utah*.—9th to 12th. *Oregon*.—Albany, 8th, 18th. *California*.—In mountains, 17th, 22nd, 23rd.

Largest Monthly Snow-falls—Mount Washington, 45.60 inches; Pike's Peak, 44.60; Genoa, Neb., 12; Newport, Vt., 11; Summit, Cal., 10; De Soto, Nebr., 9.25; Halleck, Nev. 6.

The following items, regarding in part the snow-storms of the month, will be found of interest. Sioux City, Ia., 8th, very heavy storm of sleet and snow, over ten inches on the level; wires broken and railroad communication obstructed. Orange Court House, Va., 9th, four inches fell during night. Fairmount, Minn., 11th, very heavy snow in southern Minnesota during night; trains delayed. Greenbrier county, W. Va., snow sixteen inches deep in several localities west of White Sulphur Springs. Derby Line, Vt., 15th, 16th, very heavy snow, eleven inches deep on the level. Westerville, Ohio, month opened with from twelve to fifteen inches of snow; 5th, snow-fall seven inches. Edgerton, Wis., 16th, snow-drifts from three to five feet high. Yankton, 13th, all railroads north and west still blockaded; the entire Missouri slope buried in snow. Sheldon, Ia., 8th, for sixty miles to the eastward whole country covered with from two to three feet of snow; the Chicago, Milwaukee and St. Paul R. R., for a distance of thirty miles, passed through snow-cuts, the walls of which were in many places above the tops of the cars. In Sanborn, Hartley, Spencer, Emmettsburg, Algona and other neighboring towns in Iowa, people have been cut off from the necessities of life, by snow blockades for the past three weeks, and until within a few days not a single train had passed through this section since the 1st of January; fully two-thirds of the stock in this section have perished. In the towns of Havelock and Winthrop, and others to the northward, 22nd, ground still covered with several feet of snow. In vicinity of Big Storm and Traverse Lakes, Dak., 22nd, snow partly gone from the hills, but in the ravines and gulches lies to a depth of from fifteen to fifty feet. Manitoba, 20th, snow very heavy about the tributaries of the Mississippi.

Snow from a Cloudless Sky.—Logansport, Ind., 2nd, from 8.30 to 9 p. m. fine particles of snow fell, there being no clouds visible for two hours previous, the moon and stars shining with but slightly diminished brilliancy.

Snow on Ground at End of Month.—Isolated stations report the following depths in inches: Auburn, N. H., 5; Mt. Washington, 20; Burlington, Vt., 0 to 1; Oswego, N. Y., trace; Fallsington, Pa., 0.25; Edgerton, Wis., 2.81; near Ft. Madison, Ia., 4.50; Morriston, Dak., 18; Deadwood, Dak., trace; Pike's Peak, 16.75.

Hail-storms were of considerable frequency west of the Mississippi and north of the Ohio. Beyond these boundaries, to the eastward, only three stations reported, viz: Ocean City, N. J., 2nd; Wytheville, Va., 7th; Point Judith, R. I., 14th. To the westward in the various States on the following dates: Texas, 5th, 7th, 20th, 21st, 24th, 25th and 29th. Louisiana, 12th, 21st, 29th. Arkansas, 11th and 12th; Fayetteville, 11th, very violent, storm preceded by dark heavy clouds rushing together from northwest and southwest, hailstones falling as they met; many stones from two to two-and-a-half inches in diameter; iron and tin roofs badly damaged. Indian Territory, 17th. Missouri, 29th and 30th; Ironton, 29th, town and surrounding country visited by the heaviest hail-storm ever known in this section; storm lasted about five minutes; most of the stones were as large as hen's eggs, some of them measuring more than seven inches in circumference; nearly all glass in the northern side of buildings was broken and foliage and vegetation badly damaged. Illinois, 9th, 11th, 28th and 29th. Indiana, 11th, 25th and 28th; the storm of the 28th seemed to be quite extensive, as it was reported from southern Illinois, northwestward along the Ohio River to points beyond Cincinnati. Ohio, 15th and 28th. Michigan, 16th, 28th and 30th. Minnesota, 5th, 29th and 30th. Dakota, 5th, 14th, 26th, 29th and 30th. Nebraska, 6th and 29th. Kansas, 1st, 2nd, 10th, 17th, 20th, 29th and 30th. New Mexico, 5th, 6th, 7th, 12th and 16th. Colorado, 5th, 6th, 8th, 12th, 29th and 30th. Wyoming, 9th, 10th, 14th, 17th and 23rd. Montana, 19th and 27th. Utah, Salt Lake City, 23rd. Nevada, Pioche, 18th. Arizona, 15th and 16th. California, Yosemite valley, 30th, very severe, bits of jagged ice as large as filberts fell for five minutes, covering the ground. Idaho, Ft. Lapwai, 23rd. Washington Territory, Bainbridge Island and Neah Bay, 24th.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, 54 to 80; Middle Atlantic States, 54 to 78; South Atlantic States, 55 to 85; Eastern Gulf States, 59 to 77; Western Gulf States, 54 to 75; Ohio Valley and Tennessee, 60 to 68; Lower Lake region, 62 to 74; Upper Lake region, 58 to 73; Upper Mississippi valley, 61 to 72; Missouri valley, 62 to 73; Red River of the North valley, 72 to 76; Texas, 50 to 75; Middle Plateau, 33 to 42; Southern Plateau, 30 to 76; California, 43 to 77; Oregon, 56 to 69; Washington Territory, Olympia, 78. *High stations* report the following percentages not corrected for altitude: Pike's Peak, 70.8; Santa Fe, 32.7; Cheyenne, 51.2; Denver, 45.2; Mt. Washington, 79.6.

WINDS.

The prevailing winds during the month of April, 1881, at Signal Service stations are shown on chart No. II by arrows, which fly with the wind. Throughout the country east of the Mississippi the winds were from *west to northwest* except *southwest* along the South Atlantic coast. In the Western Gulf States and Texas, *southeast to southwest* and *south*. Along the eastern slope of the Rocky Mountains, *northeast to northwest* and *north*. Over the Middle and Northern Plateau regions, *west and southwest*. Southern Plateau, *variable*. Along the Pacific coast, *west and northwest*, except *southerly* in the Northern Pacific coast region.

Total Movements of the Air.—The following are the largest total movements at Signal Service stations: Mt. Washington, 25,080; Pike's Peak, 13,503; Portsmouth, 12,886; Hatteras, 12,670; Cape May, 11,717; Chincoteague, 11,515; Kittyhawk, 11,447; Delaware Breakwater, 11,006; New Shoreham, 10,863; Wood's Holl, 10,743; Indianola, 10,382; Cape Henry, 10,373; Dodge City, 9,667; Macon, 9,335; Fort Griffin, 9,320; Sandusky, 9,150; Sandy Hook, 9,123; Barnegat, 9,108; Ft. Elliott, 9,010; Champaign, 8,991; Decatur, 8,610; Philadelphia, 8,514; Ft. Sill, 8,421; Galveston, 8,214; Cedar Keys, 8,032. The *smallest* are Florence, 1,842; Phoenix, 2,064; Roseburg and Lewiston, 2,271; La Mesilla, 2,405; Visalia, 2,424; Tucson, 2,683; Deadwood, 2,746; Silver City, 2,975.

High Winds.—Winds of 50 miles per hour and over, were reported as follows: On the summit of Mt. Washington, 2nd to 7th, 11th, 12th, 14th to 19th, 21st to 23rd, 24th, 25th, 26th, 28th, 29th, 30th, on four of these dates the wind reached a velocity of 100 miles or over; the maximum velocity, 120 miles NW., occurred on 2nd, 3rd, 29th. On the summit of Pike's Peak, 2nd, 13th, 14th, 15th; maximum velocity 68, NW. 14th; Eastport, 52, NE. 15th; Thatcher's Island, 55, NE. 15th; New Shoreham, 60, NE. 15th; Cape Henry, 52, N. 14th; Kittyhawk, 76, NE. 14th; Hatteras, 60, N. 14th; Portsmouth, N. C., 88, NE. 14th; Ft. Macon, N. C., 52, N. 14th; Indianola, 51, NE. 4th; North Platte, 54, S. 30th; Fort Stevenson, Dak., 50, W. 26th; St. Vincent, Minn., 56, SW. 26th.

Local Storms.—De Soto Co., Miss., 12th, about 2 p. m., violent tornado appeared to originate near Commerce, a small town on the Mississippi, where it wrecked ten cabins, three gin houses,

and demolished a store and its contents, valued at \$2,000. From this place the storm passed in an ENE. direction, and was next heard of at a point about five miles northwest of Hernando. In this vicinity the loss to property and life was very severe, 25 buildings of various kinds were totally demolished and 10 persons killed. Length of storm path about 25 miles, width from 100 to 300 yards. Very heavy rain and hail followed this tornado at Senatobia and several other points in the vicinity, in some cases hail-stones falling the size of hen's eggs. It is of importance to note that the occurrence of electricity or thunder was not reported as observed from any part of the tornado's path. Through portions of Prairie, Monroe, Lee and St. Francis Co's., Ark., 12th, about 2 p. m., violent tornado passed from southwest to northeast, visiting several towns, among which were Brinkley, Forrest City and Cotton Plant. After the passage of the storm at these points showers of jagged pieces of ice, four to six inches in width and two to two-and-a-half inches in thickness, fell, resembling broken river ice. These tornadoes developed in connection with the passage of low area No. III northeastward from Texas to the Ohio valley. On the afternoon of the 12th warm southerly winds prevailed along the West Gulf coast and in the interior of the bordering States, which were opposed to the northward of Arkansas and Mississippi by cold northerly winds, presenting a contrast in temperature of from 35° to 50°. Still further northward in the States of Illinois, Iowa and Colorado snow was reported, with temperatures of 19°, 26° and 27°, and to the southward in lower Texas temperatures of 80° to 90° occurred. Safford, Chase Co., Kansas, 30th, about 6 p. m., tornado passed from southwest to northeast over section of country three miles north of station; path very narrow and destruction of property considerable. This storm developed in connection with an area of low barometer then extending from northern Kansas to central Minnesota and Dakota. On the afternoon of the 30th warm southerly winds, with temperatures ranging from 60° to 87°, prevailed over the Lower Missouri valley, opposed to the northward in Dakota and Minnesota by northerly winds producing contrasts of temperature ranging from 20° to 30°. At Emporia, Kan., very high southerly winds were reported during the day. Total movement from 8.35 to 10.35 p. m., 111 miles; from 10.03 to 10.08 p. m., velocity reached the rate of 72 miles per hour; at 10 p. m., velocity 64 miles per hour. Clay Centre, Kans., 24th, very violent, blowing down houses and trees and overturning railroad cars. Mammoth Cave, Ky., 12th, very severe, maximum wind velocity sixty miles. Garysburg, N. C., 29th, blowing down trees and buildings. Elsworth, N. C., 8th, buildings unroofed and other property damaged. Clarksville, Tenn., 28th, 7 a. m., very violent wind storm; several buildings unroofed. Fort Douglas, Utah, 18th, very violent, blowing down fences and unroofing buildings.

Water-spouts.—Cairo, 28th, three water-spouts observed one-half mile southwest of station and in close proximity. Toronto, Can., 26th, 10. a. m., on lake.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for April, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.2 per cent. The percentages for the four elements are: Weather, 91.1; Direction of the Wind, 79.8; Temperature, 85.9; Barometer, 83.6 percent. By geographical districts they are: for New England, 78.9; Middle States, 82.4; South Atlantic States, 86.0; Eastern Gulf States, 82.5; Western Gulf States, 87.8; Lower Lake region, 82.5; Upper Lake region, 82.2; Tennessee and the Ohio valley, 87.8; Upper Mississippi valley, 82.1; Lower Missouri valley, 82.8; Northern Pacific coast region, 89.4; Central Pacific coast region, 96.0; Southern Pacific coast region, 92.1. There were 88 omissions to predict (33 being due to the absence of reports from the Pacific coast) out of 3,690 or 2.44 per cent. Of the 3,602 predictions that have been made, 113, or 3.13 per cent, are considered to have entirely failed; 116, or 3.22 per cent, were one fourth verified; 457, or 12.69 per cent, were one-half verified; 453, or 12.58 per cent, were three-fourths verified; 2,463, or 68.38 per cent, were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—119 Cautionary Signals were displayed during the month, of which 90, or 75.6 per cent, were fully justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 29 Off-shore Signals were displayed, of which 24, or 82.75 per cent, were fully justified; 27, or 93.1 per cent, justified as to direction; 25, or 86.26 per cent, justified as to velocity, and 1, or 3.4 per cent, completely failed. 19 of the Off-Shore Signals were changed from Cautionary. 148 Signals of all kinds were displayed, of which 114, or 77.02 per cent, were fully justified. The above does not include signals ordered at display stations where the velocity is only estimated. 149 winds, of 25 miles or over, were reported, for which no signals were ordered. 2 signals were ordered late.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river-gauges during the month of April, 1881. The Ohio, Tennessee, Cumberland, Monongahela and Savannah rivers reached their highest stages between the 14th and 18th, none of which reported any dangerous rises during the month. The Red and Arkansas rivers reached their highest stages, the former

on the 1st and the latter on the 17th, and, as compared with the past month, a marked fall was experienced, ranging from 7 to 9 feet. In the Missouri the highest stages were reached at Omaha on the 25th, and at Leavenworth on the 29th and 30th, the former rising 7 feet 10 inches above the danger-line, and the latter to 3 feet 10 inches. In the Mississippi the dates of highest water occurred with considerable irregularity at the various river stations, but generally between the 25th and 30th. At all stations above Vicksburg, except La Crosse, there were very dangerous rises, coupled with destructive floods. At the following stations the water rose above the danger-line: St. Paul, 29th, 5 feet 2 inches; Davenport, 12th, 1 foot 6 inches; Keokuk, 24th and 25th, 3 feet 8 inches; St. Louis, 30th, 1 foot 1 inch; Cairo, 19th and 20th, 5 feet 10 inches; Memphis, 26th to 29th, 2 inches; Vicksburg, 4th, 4 inches.

Ice in Rivers and Harbors.—The following items, relative to the breaking up or continuance of ice in such bodies of water throughout the northern sections of the country, exhibit the same for the month of April, 1881. In general all rivers and other larger bodies of water between the latitudes of 40° and 55° N. are open and nearly free of ice. There are one or two instances where small isolated bodies remain frozen, but so situated as to be governed by entirely local influences. As distributed by States the following arrangement of dates will indicate, about as near as possible, the time of breaking up of ice or opening of the various water-courses, &c. The dates will differ within the same geographical boundary as various parts of one State or district were at dissimilar times subjected to peculiar atmospheric influences: Dakota, 4th, 7th, 8th, 15th, 19th, 21st, 22nd, 25th; Manitoba, 20th, 21st, 25th, 27th; Minnesota, 7th, 19th, 22nd, 23rd; Wisconsin, 20th, 22nd, 25th; Iowa, 2nd, 5th, 15th; Illinois, 16th, 18th, 21st; Nebraska, 8th, 15th, 20th; Upper Lakes, 18th, 22nd, 25th, 27th; Lower Lakes, 2nd, 5th, 11th, 18th, 24th, 26th; New England, 16th, 20th, 22nd. *Missouri River.*—Yankton, 4th, ice gorging and flooding the lower portion of the city; the lower floors of over 200 dwellings, shops and mills were covered from 1 to 4 feet; great damage to property. 7th, gorge broke; water falling rapidly; steamer *Peninah* carried away from her moorings and lodged on a railroad track two miles down the river; reports from the submerged farming districts state that about 200 persons have perished from cold and hunger; thousands of cords of wood have been carried away by the ice, leaving whole communities destitute of fuel. 12th, river stationary; ice running in channel. 13th, water in the overflowed districts gradually subsiding; ice piled to a height of 10 to 30 feet along the banks, on the bars and over the bottoms. At Green Island every house but one has been swept away; ice throughout the place from 10 to 20 feet deep. Damages to steamboat property estimated at \$60,000, including two boats sunk; seven of the largest steamers lying high up on the ice and far inland. In the vicinity of Yankton it is estimated that at least 7,000 people have been driven from their homes; the ice gorge which has caused this unprecedented flood extended to Vermillion, filling the river channel for a distance of over 30 miles with solid ice and rising in places to a height of over 30 feet above the surface of the water; about fifteen miles below Yankton, in a bend of the river, were situated 20 families, who could not be rescued because of the mountains of ice surrounding them. Omaha. 7th, for several days past heavy floating ice; to-day the river was one vast field of ice, cakes varying in size from three to one hundred feet square; trees, logs, bridge timbers, the debris of houses, &c., were constantly passing. Sioux City, Ia., 8th, ice gorge below city still intact. 9th, heavy floating ice in river. Mandan, Dak., 8th, the immense fields of ice about the city still intact; over one hundred men employed in cutting out the railroad track and in opening a road through the heavy ice on Main street. Ft. Sully, Dak., 25th, river clear of ice; first boat arrived. Gayville, Dak., 15th, town submerged to a depth of six feet, and surrounded by heavy ice. *Mississippi River.*—St. Paul, 6th, ice broke up; 7th, gorged; 9th, gorge broke; 10th, river full of floating ice. Davenport, 1st, ice broke up in the channel over the rapids; 2nd, river open from the bridge down to the ferry crossing at the foot of Main street; at some places along the shore ice piled up to a height of 30 feet, composed of huge blocks three feet in thickness; at the Government bridge ice was gorged over five acres in extent; 3rd to 13th, floating ice, occasionally heavy; 15th, completely filled the river at many places, and extended for ten miles; ice varied in thickness from fourteen to twenty-four inches; navigation open; 16th, areas of thirty to forty acres passed down in a body; levee flooded for two miles; at 11 a. m., water stood seven inches deep in stores, warehouses and machine shops on Front street, and whole blocks of dwelling houses were inundated; saw mills suffered heavily, many piles of lumber and rafts swept from their booms; one raft of 600,000 feet of lumber was broken up and carried away in front of the city. At 11.45 a. m., water rose to 18 feet 8 inches above low-water mark, being 4 inches higher than ever before recorded. Burlington, Ia., 1st to 3rd, heavy floating ice, occasionally gorging; 4th, navigation open, floating ice, but not seriously impeding the movement of vessels; 5th to 16th, floating ice, occasionally heavy; 17th, river clear of ice. Clinton, Ia., 14th, ice broke up and passed out, causing but little damage; 16th, navigation open, being one week later than any previous spring for the past 20 years; river closed for 149 consecutive days. Dubuque, Ia., 5th, ice moving slowly; 8th, ice gorged; 9th, gorge broken by use of dynamite; 12th, navigation open. Little Falls, Minn., 19th, ice passed out, causing no serious damage; streams very low for this season of the year. *Saskatchewan River.*—Battleford, B. A., 20th, ice broke up; 21st, ice gorged and river overflowed; 22nd, river higher than ever before, all bridges for miles about swept

away; every house in lower part of town flooded; water of unusual depth in swamps along the line of the Canada Pacific, between Winnipeg and Portage la Prairie, owing to the sudden melting of heavy snow. *Red River of the North.*—Winnipeg, B. A., 22d, ice began moving at 11 a. m., first movement since the setting in of winter. Two barges were carried away near the mouth of the Assiniboine river by the descending ice. Pembina, Dak., 22nd, ice in river began moving at 11:30 a. m., water rising at the rate of two inches per hour. Breckinridge, 27th, river clear of ice from this point to Lake Winnipeg; river 25 to 30 feet above low water mark and rising. Grand Forks, Dak., 21st, ice in river breaking away from shore and gorged at several places; 29th, river entirely free of ice; all buildings on the bottom lands washed away; ice gorged at the mouths of several small tributaries, flooding the low lands for 25 miles between Turtle river and Acton. Fargo, Dak., 22nd, ice began to break up and move out slowly; no serious damage. *Big Stone River.*—Elk Point, Ia., 15th, railroad track covered with ice for miles; ice carried inland by the flood, in some places to a depth of four feet. *Minnesota River.*—Granite Falls, Minn., 22nd, river clear of ice at this point, but gorged heavily at a bend of the river below the town. Minnesota Falls, 22nd, gorge broke and carried away wagon bridge; loss \$4,000. *James River.*—Morriston, 19th, ice broke up; 20th, water flooded valley; 23rd, river reached its greatest height; average depth on low lands 9 feet. *Pepin Lake.*—Lake City, Minn., 24th, ice breaking up and occasionally gorging; 25th, ice passed out; Mississippi now open above and below. Red Wing, Minn., 23rd, ice in lake still firm; river has risen three feet and still rising. *Niobrara River.*—Niobrara, Neb., 8th, ice heavily gorged on either side for miles; river rising rapidly. *Sheboygan River.*—Mission House, Wis., 22nd to 25th, ice breaking up and passing out, causing much loss of property, especially bridges, mills and dams. Manitowoc, Wis., 20th, river open, water higher than ever before; ice passed over the banks, carrying away fences, bridges and dams. *Milwaukee River.*—Milwaukee, Wis., 20th, ice breaking up; 21st, gorging heavily in places, river overflowed; 22nd, ice gorge passed out, carrying away a portion of wagon bridge, and causing considerable other damage. *West Branch Canal.*—Milton, Pa., 15th, ice breaking up; 16th, passing out slowly with occasional gorges; 17th, navigation open. *Lake Geneva.*—Bloomfield, Wis., 30th, ice 18 inches thick and still firm. *Rock River.*—Beloit, Wis., 27th, river $5\frac{1}{2}$ feet above low water mark, highest water ever known, much damage to property. *Black River.*—Neillsville, Wis., 26th, ice all out, no serious damage. *Fox River.*—Elgin, Ill., 21st, ice gorged for a distance of nine miles, and piled up to a height of 12 feet, damage to property already \$500,000. *Rock River.*—Lyndon, Ill., 16th, ice broke up in river; 20th, water highest ever known. Rockford, Ill., 21st, river rose from 4 inches above low water mark on the 12th to $58\frac{1}{2}$ inches on the 20th, highest water ever known. *Lake Michigan.*—Chicago, 1st to 11th, lake frozen firmly along shore; 12th, ice began moving. Milwaukee, 1st to 25th, bay covered with ice; 26th, ice broke up and passed out; 30th, clear of ice. Benton Harbor, Mich., 2nd, ice broke up, destroying over 500 feet of Pike's pier; at Riverside 2,500 railroad ties carried away. *Green Bay.*—Escanaba, frozen over during month. *Lake Superior.*—Duluth, 1st to 26th, lake frozen solid as far as the eye can reach; 27th, ice broke up during the morning; 28th, moved out in lake 10 miles; 30th, entirely disappeared. Marquette, harbor covered with ice during the month. *Grand River.*—Grand Haven, 1st to 7th, frozen over; 8th, ice broke up; 10th, river clear. *Alpena River.*—Alpena, 1st to 17th, river frozen over; 18th, ice broke up and passed out, causing no damage; 19th to 21st, full of floating ice; 22nd, clear of ice. *Detroit River.*—Detroit, 2nd to 5th, heavy floating ice; 6th, 7th, light floating ice; 8th to 12th, heavy; 13th, light; 14th, heavy; 15th, heavy, reaching from shore to shore; 16th to 18th, light; 19th, clear of ice. *Lake Erie.*—Cleveland, 24th, lake covered with broken ice, but not impeding navigation. Little Mountain, Ohio, 30th, ice along the shore still intact. Erie, Pa., 5th, ice in bay rapidly disappearing, with a clear opening extending from channel to waterworks, and from shore to shore; outside of bay fields of ice stretch as far as the eye can reach; outlook very unfavorable to the early opening of navigation. Cleveland, 1st to 18th, lake closed by ice; 19th, ice moved out from around docks; 20th to 24th, ice remained stationary; 25th, ice disappearing. *Sandusky Bay.*—Sandusky, 1st to 10th, bay frozen over; 11th, ice breaking up; 15th, clear of ice. *Lake Ontario.*—Oswego, 18th, ice melting and disappearing; 25th, lake clear of ice. Rochester, 11th, ice disappeared from harbor; 15th, floating ice in lake; 22nd; lake clear as far as eye can reach. *Lake Champlain.*—Plattsburg Barracks, N. Y., 16th, ice broke up. Burlington, Vt., 1st to 19th, broad lake frozen over; 20th, ice breaking up; 21st, ice passed out. *Lake Massabesic.*—Auburn, N. H., 20th, lake free of ice.

Floods.—This subject assumes more than usual interest during the present month, because of the unprecedented loss of life and property, and, not least, the extreme height to which the water rose during the prevalence of the flood. In connection herewith, as presenting some of the probable causes which were at work in the production of this great calamity other than the immediate influence of the breaking up of ice, it will be well to note that in the Northwest, up to about the 12th, snow was upon the ground to the depth of 15 to 50 feet, the accumulation of almost the entire winter, and in the Upper Mississippi valley as far south as Burlington, Iowa, it varied from 3 to 5 feet. In this connection it will be of interest to recall the fact that, during the month of March just past, these regions were subjected to the heaviest snow-storms experienced, in many

instances, for a period of twenty-five years. With this remarkable accumulation of snow there appeared the preserving concomitant of very low temperatures, for, as records will show, the mean temperature for March throughout the Upper Mississippi and Missouri valleys was from -1.4° to -3.1° below the normal, a very important factor, and tending materially to prevent the gradual and, therefore, harmless disappearance of the large mass of snow. Further, it will be remembered that, during the past winter, ice formed in the western rivers to a thickness and extent, in several instances, never before realized. With these conditions precedent, the month of April opened with occasionally heavy falls of snow and low temperatures, the minimum of the month, which ranged from -14° to $+18^{\circ}$, occurring between the 1st and 12th. Following this, the temperature rose slowly until the 20th, after which the change was more rapid, reaching the maximum of the month between the 22nd and 26th. It would seem that in the above we have an epitome of the principal forces incident to the remarkable floods of April, 1881. Roughly estimated, but, nevertheless, said to be underrated, rather than exaggerated, the loss of property has been placed in money value at the following figures: Over the territory from British America southward to the latitude of Sioux City, Iowa, \$3,500,000; from Sioux City to the latitude of St. Louis, \$2,500,000. *British America.*—Manitoba, 22nd, all streams emptying into the Red River of the North overflowed, great loss to lumbermen and farmers. Winnipeg, 29th, river 25 feet above low water mark, several grain warehouses flooded. Emerson, 29th, lower portion of town flooded, bridge carried away. *Dakota.*—Vermilion, 8th, forty-five houses swept out of the town, highest water ever known. Grand Forks, 21st, Red river rose 16 feet in past thirty-six hours. Casselton, 22nd, entire town nearly under water, flood unprecedented, all communication closed. Meckling, 8th, entire town carried away, except the elevator, in which were gathered for safety about 1,000 people. Fort Sisseton, 22nd, all bridges between this point and Brown Valley carried away; the entire valley on the Dakota side of the Minnesota river covered to a depth of several feet. Mapleton, 22nd, town completely submerged, loss of property very great. Yankton, 8th, bottom lands for miles in every direction submerged, nearly 1,000 people have been rescued from farm houses and other buildings in this county alone; some people in their dwellings are still surrounded by ice walls of almost impenetrable character; 14th, in the district between Yankton and Vermillion, a distance of 25 miles, 2,500 people were suffering for the necessities of life, and below Vermillion to Big Sioux 5,000 more were completely destitute; from the records of the Surveyor General's office, it has been ascertained that the flood on the Dakota side of the Missouri, covered over 227,000 acres. Pierre, 8th, town completely under water; the floods in this section and for miles on either side are unparalleled; the bottom lands for a width of over fifteen miles were overflowed, making a perfect inland sea. Big Stone City, 23rd, Whetstone River overflowed, flooding the country for miles; Big Stone Lake 7 feet above high-water mark, highest ever known; all bridges gone and several miles of the Hastings and Dakota Railroad washed away. Union County, 15th, water disappearing rapidly, leaving thousands of acres covered with huge cakes of Missouri ice, hay and straw stacks, wire fences, wrecked houses, and the debris of bridges. Civil Bend, 15th, heavy river ice covered the fields for miles to the depth of 6 to 8 feet, rendering travel of any kind almost impossible; all sloughs filled with water and have to be crossed in skiffs; houses either wrecked by the ice or floated off by the water; hay, grain, fencees, saw-logs, lumber and cord wood, entirely swept away; loss of stock very severe. Fargo, 23rd, Red River rose four feet during night, but could rise ten feet more without serious damage; at Williams' farm, 16 miles west, entire country flooded. *Illinois.*—Rockford, 20th, majority of town flooded, water in many cases flowing into the windows of dwellings; water 22 inches higher than the high-water mark of 1877; river two to three miles wide; loss of property in Kane County estimated at \$300,000; in the newspaper offices, men at work with a foot of water beneath them. Sterling, 29th, Rock River 12 feet above low-water mark and rapidly rising; lower part of city flooded; Chicago and Northwestern Railroad covered with water for five miles; river between Sterling and Erie overflowed, submerging the country for many miles; loss of property estimated at \$150,000. Milan, 20th, town partially submerged, bridge swept away; loss, \$20,000. Chicago, 19th, Desplaines River greatly swollen and pouring into the canal; 20th, canal broke its barriers, flooding all cellars and basements in vicinity; flood spread considerably in southwestern part of city; several lumber yards inundated and all the docks on the south side were invisible; at 2 p.m., flood extended from Lincoln street to the river, a distance of over two miles; canal filled with floating corn and hay, brought down the river from inundated farms in the surrounding country; water several inches higher than the flood of 1847, which was the highest point ever reached; 21st, flood increasing; only four cars of freight arrived during day; every railroad track that enters the city covered with water; several street bridges washed away. Elgin, 20th, Fox River overflowed, portion of city submerged, two bridges and a dam swept away; loss, \$150,000; bridges and dams at Carpenterville, Dundee, South Elgin, St. Charles and Geneva were carried away; loss, \$200,000; flood so irresistible that buildings were swept down the stream like shingles; Milwaukee and St. Paul Railroad bridge carried away, severing all communication westward for twelve days. Rock Island, 15th, 11 a.m., three fourths of the city under water, general depth in business part of town 12 inches, while in the lower portions it was from three to four feet; 200 families driven from their homes; 11.45 a.m., gorge broke, water receding four feet in thirty minutes. Joliet, 20th, Desplaines River highest ever known; lower portion of city flooded; damage to property \$50,000.

Dixon, 19th, Rock River overflowed, much damage to property. Quincy, 20th, all low lands above and below the city entirely inundated; river five miles wide; thousands of acres of farming lands overflowed; much loss of stock, farm machinery and buildings. Venice, 25th, town entirely surrounded by water; people abandoning their houses. Madison, 25th, new levee broken; all farms on the American bottoms flooded; loss of stock, farm buildings and implements very great. *Iowa.*—Ft. Dodge, 25th, Des Moines River overflowed; rose 6 feet in 30 hours; families on low lands abandoned their homes. Iowa Point, 30th, water up to the windows of the depot; every house flooded. Plum Hollow, 29th, great destruction of property and much suffering on the bottom lands throughout Fremont County; hundreds of families driven from their homes; flood unprecedented. Hamburg, 29th, railroad track from this point to Council Bluffs entirely washed away; all telegraph poles down; town flooded, houses abandoned. Sioux City, 8th, portion of city flooded to a depth of 4 to 6 feet; 21st, Big Sioux, Floyd, and other streams overflowed, causing great damage to wagon and railroad bridges; 29th, water rose 2 feet in past 24 hours; many families driven from their homes in the surrounding country by the overflow of creeks and small rivers. Lemars, 22nd, Floyd River overflowed; several bridges swept away together with 200 feet of railroad track. Des Moines, 22nd, river falling; debris of buildings and bridges floating by for several days. Council Bluffs, 8th, all bottom lands about the city completely under water and many families in the suburbs compelled to abandon their houses; 9th, water rising rapidly; nearly one-half of the city submerged to a depth of three feet; people rapidly deserting their homes; a broad and heavy stream coming in from a bend in the river north of the town swept down Broadway, the principal business street, carrying away a large amount of property; on the west side of the town the Union Pacific transfer depot, the bridges over Spoon Lake, together with the Union Stock Yards and numerous residences and railroad buildings, were inundated; all railroad communication has ceased; all transfers have to be made by boats, or by shoving flat cars through the water over the small bridges; several hundred loaded freight cars were entirely submerged; the Kansas City, St. Joe and Council Bluffs R. R., from the latter place to Pacific Junction, a distance of eighteen miles, was completely under water; ice piling up fast all over the flooded section; 22nd, river rising at rate of one inch per hour; all bottom lands flooded to a depth of four to six feet; railroad tracks and the Union depot inundated; water 17 inches higher than ever before known; 23rd, river now eight miles wide; over 500 houses in southern part of city surrounded by water; all communication with Omaha cut off; 29th, water 22 feet above low-water mark; 300,000 feet of lumber washed away during day by breaking away of coffer-dam. *Kansas.*—Burr Oak., 30th, town entirely flooded, water reaching to the eaves of many buildings; inhabitants floating about on rafts or buoys day and night. Elmwood, 30th, town submerged; inhabitants lost everything. Wathena, 30th, town flooded; people passing about in skiffs or on rafts; houses abandoned. Belmont, 30th, all bottom lands under water; town abandoned. George City, 30th, lower portion of city and the adjacent bottoms submerged; all railroad communication cut off; highest water ever known. Atchison, 25th, water 20 feet 8 inches above low-water mark; highest point ever reached; all houses on the east bank south of railroad track flooded; brick stack over 200 feet from shore; all low lands between the timber belt and town submerged; ice houses at Sugar Lake undermined and destroyed; 26th, East Atchinson entirely surrounded with water; people leaving in boats for places of safety. Oak Mills, 29th, entire town swept away; large island near by, upon which were gathered all the stock of the neighborhood, was submerged, drowning the animals. Troy, 30th, all bottom lands overflowed; water highest ever known; town deserted. Leavenworth, 12th, river overflowed; all railroad travel suspended; 14th, river falling; 15th, railroad travel resumed; 22nd, water rising; railroad track again submerged; 23rd to 26th, river rising slowly; bottom lands overflowed and much property washed away; 27th, water 5 to 20 feet deep over the bottoms, with a width of over two miles; all buildings abandoned; several miles of railroad track washed away; river filled with debris of every description, showing that destruction of property above has been immense; 28th, river rose rapidly all day, houses and barns carried away and much stock along the Missouri river bottoms drowned; opposite city, bottoms from 3 to 10 feet under water; over 100 families left destitute; town of east Leavenworth entirely abandoned and several houses floated away; river over three miles wide; highest water since 1844. *Michigan.*—Alpena, 29th, Richardson's dam near mouth of Alpena river carried away by unprecedented high water; 500,000 feet of logs swept out into the bay. *Minnesota.*—St. Paul, 29th, water 19 $\frac{1}{2}$ feet above low water mark; west St. Paul entirely submerged; every house abandoned; water so deep that some of the houses only showed their gables above the flood; river full of debris of every description, coming down from the upper portions of the State; hundreds of cattle, horses and hogs drowned in the surrounding country; on the east side, flats above the city covered with water and the Sioux City shops and stock yards surrounded. The following are dates of highest water for many years past: June, 1851; July and August, 1852; April, 1862; April 23rd, 1866; April 19th and July 20th, 1867; April 18th, 1869; April 1st, 1870. Loss to railroads and private property, over \$100,000. Cassilton, 25th, Red Lake River overflowed, inundating the town; people abandoning their homes. Bell Plain, 25th, bottom lands covered to a depth of five feet. Lenseur, 25th, town partially under water; wagon bridge carried away. Halleck, 25th, all low lands under water; highest water ever known. Redwood Falls, 22nd, Minnesota river highest since 1868; water fifteen feet above low-water mark; Ramsey creek 11 feet above low-water mark, highest since the floods of 1870; all dams and bridges

in vicinity carried away. Le Sueur, 22nd, river covered the entire valley between the bluffs, water rising two inches per hour; 23rd, water rose 30 inches during night; Henderson bridge carried away; greatest flood ever experienced in this section. Mankato, 23rd, lower portion of town flooded to a depth of several feet: West Mankato, Le Hillier and the city flats covered with water 2 to 5 feet deep; several hundred cords of wood carried away; Mineopa and Warren creeks overflowed, causing much damage in the vicinity; warehouses at Gardiner City, containing 7,000 bushels of wheat, swept away; all railroad tracks completely washed out. Marshall, 22nd, Redwood river overflowed; bottom lands under water, and also all of the railroad tracks between this place and Amiret. Springfield, 22nd, Cottonwood river overflowed; thousands of acres under water; all communication cut off. Carver, 22nd, river 10 feet above low-water mark; portion of the town under water. Huron, 22nd, James river overflowed; several buildings submerged to a depth of three feet. Sleepy Eye, 22nd, surrounding country submerged; all railroad travel closed. Burns, 22nd, Cottonwood river overflowed; railroad bridge and 80 feet of track carried away. St. Peter, 22nd, river rising very rapidly, washing away over 700 feet of railroad track; river opposite town over a mile wide; largest portion of town flooded. Granite Falls, 25th, town entirely surrounded by water; all bridges carried away. Minnesota Falls, 23rd, all the bottoms covered to depth of 4 to 6 feet; water highest ever known. St. James, 22nd, Watonwan river overflowed; railroad bridges at Wadelia carried away; all railroad communication cut off. Shakopee, 23rd, water 3½ feet above low-water mark, or 26 inches higher than ever before recorded, damage to property very great. Brainerd, 23rd, water at ordinary stage in upper Mississippi; no prospects of flood yet. Big Stone, 28th, town flooded; railroad tracks washed away; highest water ever known. Sioux Falls, 22nd, three street bridges carried away; property of the Sioux Falls Water Power Co., seriously damaged; 27th, several flouring mills carried away; every building in the town more or less damaged; loss estimated at \$140,000. Fergus Falls, 25th, upper country one unbroken sheet of water for about 25 square miles. Ortonville, 25th, bottom lands covered with 4 feet of water; highest flood ever experienced. Crookston, 25th, all the low lands between this place and Glyndon overspread with ice, carried up by overflowing rivers and creeks; Red Lake river above its banks; wagon bridge carried away. Stevenson, 25th, surrounding country covered with water; railroad tracks washed out; all communication closed. Montevideo, 22nd, river higher than for many years; water extends from bluff to bluff in a vast lake, varying in depth from 8 to 10 feet; in lower portion of town houses filled with 4 to 8 feet of water; bridge across the Chippewa river carried away; all communication cut off; 23rd, water still rising rapidly; all of the bottom lands at the confluence of the Minnesota and Chippewa rivers one vast sea of water, covering many thousands of acres; many miles of railroad track washed away; all bridges on Dry Weather creek carried away. St. Cloud, 23rd, Mississippi at ordinary stage, not as high as one year ago, but rising slowly; Sauk river, two miles above town, rising very rapidly. Log driving on Daggett brook, the Willow, Partridge and other small rivers, tributary to the Mississippi, has commenced without fear of floods. Missouri.—Craig, 25th, water three feet deep in stores and houses; all business suspended; portion of town abandoned. Phelps City, 25th, town nearly submerged; inhabitants fled to the bluffs for safety; highest water and most destructive flood ever known. St. Joseph, Mo., 25th, river 20 feet 9 inches above low-water mark, or 9 inches above the highest point ever reached; French bottoms, above city, flooded; people abandoned their houses; opposite city all lands flooded; inhabitants fled to the hills for safety; railroad machine shops surrounded and all tracks under water. Hannibal, 21st, railway tracks on Front street submerged; steamer warehouses entirely surrounded; 25th, 3 a. m., Sny levee broke at a point 1½ miles above East Hannibal, crevasse 130 feet and still cutting; loss of ice, up to date, about 28,000 tons; river over 19 feet above low-water mark and still rising. Forrest City, 25th, levee built to protect town of Harlem and the broad bottom lands opposite city gave way during the night, flooding the latter to a depth of 10 feet; in the town of Harlem only six houses above the water-line, a large number of neighboring farms 4 to 6 feet under water; 29th, 7,000 people driven from their homes; all the railroad tracks under water; business entirely suspended; over 1,500 houses flooded and abandoned. St. Louis, 25th, Sny levee broke during the evening opening a crevasse 175 feet wide, flooding 40,000 acres of growing wheat; estimated value of ice houses and ice destroyed, over \$100,000; about 40 miles of the Keokuk and St. Louis R. R. inundated. 28th, large portion of North St. Louis and Carondalet submerged, all bottoms on the Missouri side flooded, and situation on the Illinois side very deplorable; all buildings and railroad tracks between the stock yards and Venice badly damaged, water several feet deep. Lexington, 29th, river 22 feet and 8 inches above low-water mark, highest since 1844; the Roy and Lafayette county bottoms submerged and rapidly depopulated; thousands of horses, cattle and hogs perished, water seven feet deep in many of the houses. Oregon, 24th, all the bottom lands flooded, about 3,000 people in Holt county rendered homeless; river reached its highest point on the 27th, higher than ever before experienced, not excepting the great flood of 1844. Nebraska.—Covington, 8th, town completely submerged and entirely abandoned by its inhabitants. Brownville, 25th, town partly under water, all business suspended. White Cloud, 26th, river highest ever known, railroad tracks washed out, several buildings under water. Doniphan, 26th, water highest since the flood of 1844, all the low lands under water, great loss to railroad and other property. Nebraska City, 26th, river at this point 10 miles wide; it is estimated that about 10,000 head of cattle have perished along the bottom

lands. Jackson, 7th, entire portion of state between this point and Covington submerged, all communication cut off, loss of property without precedent; no such flood since the settlement of the country. Plattsmouth, 23rd, all bottom lands under water to a depth of six to eight feet, farmers on Iowa side have abandoned their houses and report heavy losses of cattle. Pacific Junction, 23rd, town submerged to a depth of four to eight feet; great suffering and much loss of property. Omaha, 8th, river 21 feet above low-water mark, highest ever known here and $2\frac{1}{2}$ feet higher than the April flood of 1875 or the June flood of 1867; everything on the levee submerged and the low lands on the east side of the river flooded for miles; river three miles wide opposite the city and filled to a considerable extent with floating ice; twelve of the largest buildings of the U. P. R. R. Co.'s shops were flooded to a depth of six to twelve inches and 1,300 men temporarily thrown out of employment. 9th, river opposite city increased to a width of six miles; damage to property immense. 20th, water 20 feet above low-water mark; all the bottoms again submerged; railroad business entirely suspended, shops and depots flooded. 22nd, water 22 feet 10 inches above low water mark and rising at the rate of one inch per hour; all railroad connections severed; Union stock yards flooded; 300,000 feet of lumber carried away; Elkhorn river overflowed, railroad partially carried away. 23rd, 2 p. m., river 23 feet and 4 inches above low-water mark, or 16 inches higher than ever before recorded; all passengers going east compelled to pass to the local depots in boats; \$30,000 worth of lumber carried away. 24th, water 4 feet higher than the flood of 1867; current very rapid; all railroad tracks washed away. 29th, water still rising; 50,000 feet of lumber carried away; the Union Pacific R. R. shops, smelting works, Willow Springs distillery and several large warehouses flooded. *Texas.*—Huntsville, 22nd, heaviest storm of rain ever known here; surrounding country flooded; all bridges carried away; crops seriously damaged. *Wisconsin.*—Beloit, 20th, town partially inundated; great loss to mill property. Fort Atkinson, 20th, all the low lands flooded; ice came down in huge masses, crushing bridges, dams and every obstacle in its path; water rose to within a few inches of the top piers of the city bridge; highest ever known. Milwaukee, 21st, flood, highest and most destructive ever known here; basements along the docks and several lumber yards and tanneries submerged. At West Bend, Thevisville, Newburg and other neighboring places all dams and bridges gone.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. III. Owing to ice, breakage of instruments and opening of new stations, observations are wanting as follows: Atlantic City, 1st to 20th; Alpena, 1st to 17th; Boston, 1st to 21st; Burlington, Vt., 1st to 20th; Cleveland, 1st to 18th; Chicago, 1st to 11th; Detroit, 1st to 5th, 15th and 16th; Duluth, 1st to 26th; Escanaba, 1st to 31st; Grand Haven, 1st to 7th; Marquette, 1st to 31st; Milwaukee, 1st to 25th; Newport, 1st to 24th; New Haven, 1st to 22nd; New Shoreham, 1st to 16th; Port Eads, 1st to 9th; Sandusky, 1st to 10th.

ATMOSPHERIC ELECTRICITY.

Auroras.—There have been an unusual number of displays reported from the Lake region. Most of them occurred on dates coincident with those in other districts to the east and west, thus completing the connection which frequently has been wanting over this region, from one cause or another, generally presumed to be cloudiness and therefore frustrating any attempt to trace a continuous line of observation from east to west, which, from the nature of auroral display is known to be its ordinary disposition. The most important display, where the continuity of observation was unbroken, occurred on the 27th and extended from Mt. Washington to stations in Oregon and Washington Territory and as far south as latitude 38° , seventeen intervening stations reporting. The following were less extended displays but generally visible from New England westward to the Mississippi. 17th, from northern Vermont to northern Indiana and south to latitude 41° , two intervening stations reporting. 18th, from Mt. Washington to Madison, Wis., and south to latitude 43° , seven intervening stations reporting. 19th, from Halifax, N. S., to Escanaba and as far south as latitude 42° , six intervening stations reporting. 20th, from Sydney, Cape Breton Island, to Fort Stevenson, Dak., and southward to latitude 38° , twenty-seven intervening stations reporting. 21st, from Buffalo to Fort Stevenson, Dak., and southward to latitude 43° , two intervening stations reporting. 24th, from Eastport, Me., to Spiritwood, Dak., and southward to latitude 45° , three intervening stations reporting. 28th, from Halifax, N. S., to Spiritwood, Dak., and southward to latitude 40° , fifteen intervening stations reporting. 30th, from Catawissa, Pa., to Vevay, Ind., and southward to latitude 39° , one intervening station reporting. The following were local displays: Williamstown, Mass., 3rd, 8:30 p. m., faint; Burlington, Vt., 4th, 9 to 11 p. m.; Albany, 1st, 11 p. m. to midnight; Duluth, 1st, until 3 a. m.; St. Vincent, Minn., 3rd; Ft. Brady, Mich., 1st, 9 p. m., faint; Eola, Or., 15th, p. m., very faint.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 177 stations

show 5,281 observations to have been made, of which 36 were reported doubtful; of the remainder 4,479, or 85.4 per cent. were followed by the expected weather.

Earthquakes.—Ischia, Island of Ischia, Mediterranean Sea, March 4th, 1881, during the afternoon very violent shock, lasting seven seconds and accompanied by a noise like subterranean thunder, followed immediately by the crash of falling houses. Two hundred houses were thrown down and many others damaged or made uninhabitable; total number of persons killed and wounded, 312. At Amenes, a smaller city on the same island, thirteen houses were destroyed and five people killed. It was at first supposed that this disaster was due to some influence connected with an eruption of Mt. Vesuvius, which occurred the day previous, but more deliberate judgment inclined to the belief that the shock was caused by the continual working of mineral waters through into a subterranean corrisor. Near the centre of the island is situated Mount San Nicolo or Epomeo, an extinct volcano rising to the height of about 2,600 feet, from which Ischia, the capital city, has suffered severely in past years by frequent eruptions. Rio Vista, Cal., April 10th, 2 a.m., slight shock. Sacramento, 10th, 2 p.m., direction W. to E., three separate and distinct shocks, following each other in rapid succession. San Francisco, 10th, 2:5 a.m., oscillation from N. to S., duration of shock about two seconds. Los Angeles, 27th, 9:10 p.m., direction from SW. to NE., duration two seconds. Visalia, 10th, 2:02 a.m., direction N. to S., duration two seconds. Yosemite valley, Cal., 10th, 1:53 a.m., wave from NW. to SE., slight tremulous motion. Oakland, Cal., 10th, 2 a.m., shock, accompanied by a rattling noise sufficient to awaken inhabitants. Antrim, N. H., 3rd, at 4:52 a.m., only one shock, sounding like snow-slide from roof of house. U. S. steamer *Galena* reports, as follows: "During our stay at Castro, Island of Scio, frequent slight shocks of earthquake were plainly felt on board. They were of two kinds—one a rumbling sound, with tremulous motion of ship; the other, a distinct motion of the vessel, accompanied by a report like a distant mining blast. At 7:15 p.m., April 11th, a heavy shock was felt, shaking the ship violently; it was followed by the sound of falling walls ashore and the roar of human voices. A great white cloud of dust rose over the city and gradually settled out of sight."

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:

DATE— April, 1881.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
2, 9 a. m.....	1	5	0	0	1	1	3	10	Few faculae.
3, 10 a. m.....	2	11	1	1	1	2	4	20†	Faculae.
5, 8 a. m.....	0	0	0	0	0	0	4	20†	Faculae.
6, 7 a. m.....	1	3	0	0	1	3	5	15†	Faculae.
7, 7 a. m.....	1	3	1	5	1	3	4	14	Faculae.
10, 10 a. m.....	0	3	.....	.....	0	3	3	8	Faculae.
11, 8 a. m.....	0	0	0	0	0	0	2	7	Faculae.
14, 6 a. m.....	2	15	.....	.....	.....	.....	3	20†	Faculae.
15, 5 a. m.....	0	20†	0	0	0	0	3	40†	Many of the spots small.
17, 7 a. m.....	4	15	0	0	3	10	7	55†	Many of the spots small.
21, 9 a. m.....	0	60†	.....	.....	.....	.....	6	115†	Many of the spots small.
23, 7 a. m.....	0	0	1	20†	0	0	4	85†	Many of the spots small. Spots probably disappeared by solar rotation.
24, 9 a. m.....	0	0	1	10	0	0	3	60†	Many of the spots small.
26, 8 a. m.....	1	5	0	10	0	0	4	55†	Many of the spots small.
28, 7 a. m.....	0	0	2	45†	0	0	3	10	Faculae.
29, 8 a. m.....	0	0	0	0	0	0	3	10	Faculae.
30, 9 a. m.....	1	4	2	9	1	4	2	5	Faculae.

† Approximated.

Mr. H. D. Gowey, at North Lewisburg, Ohio, reports: observed sun spots on all clear days during the month.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Brig. & Bvt. Maj. Gen'l,
Chief Signal Officer, U. S. A.

Copy furnished for

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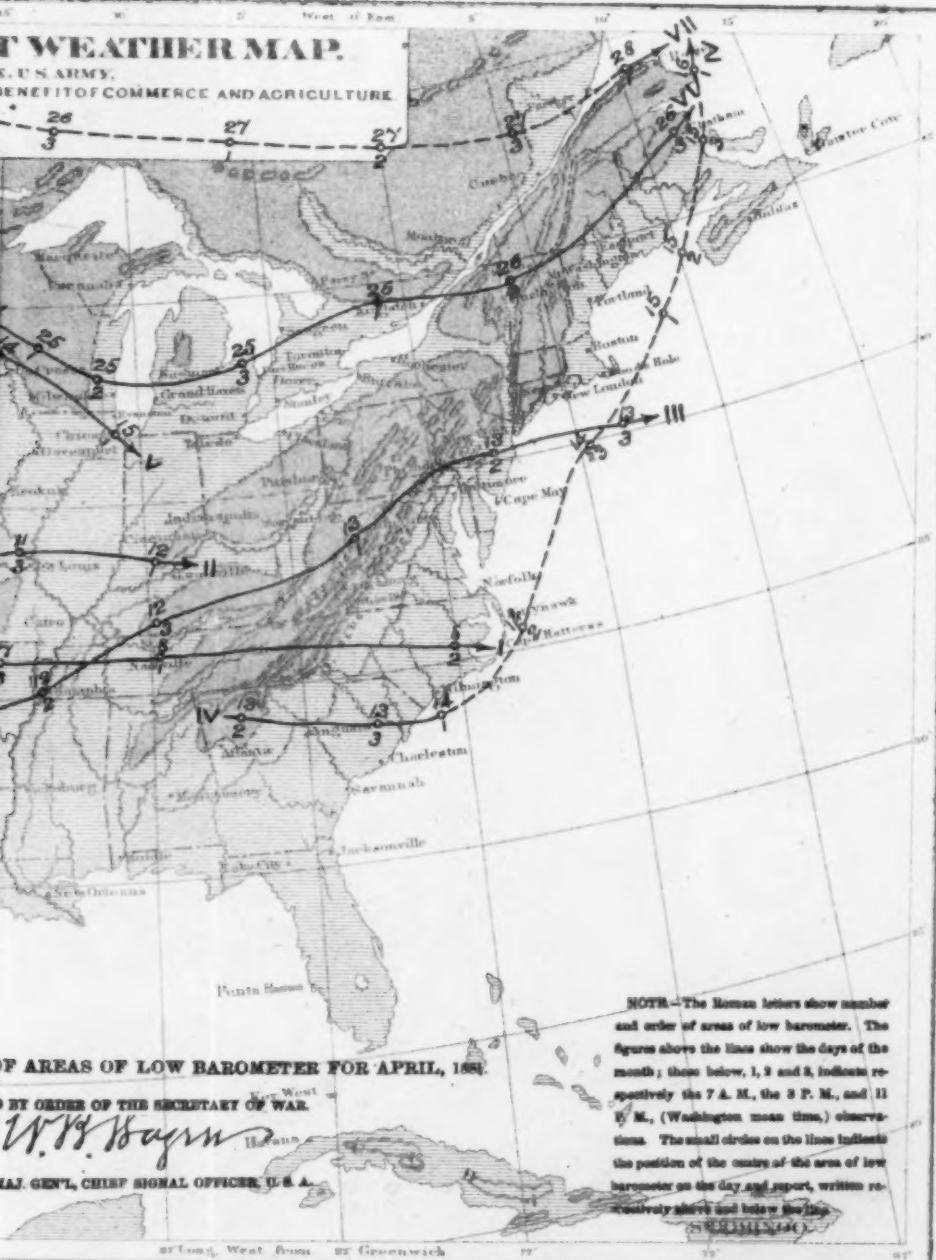


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DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF



No. I.



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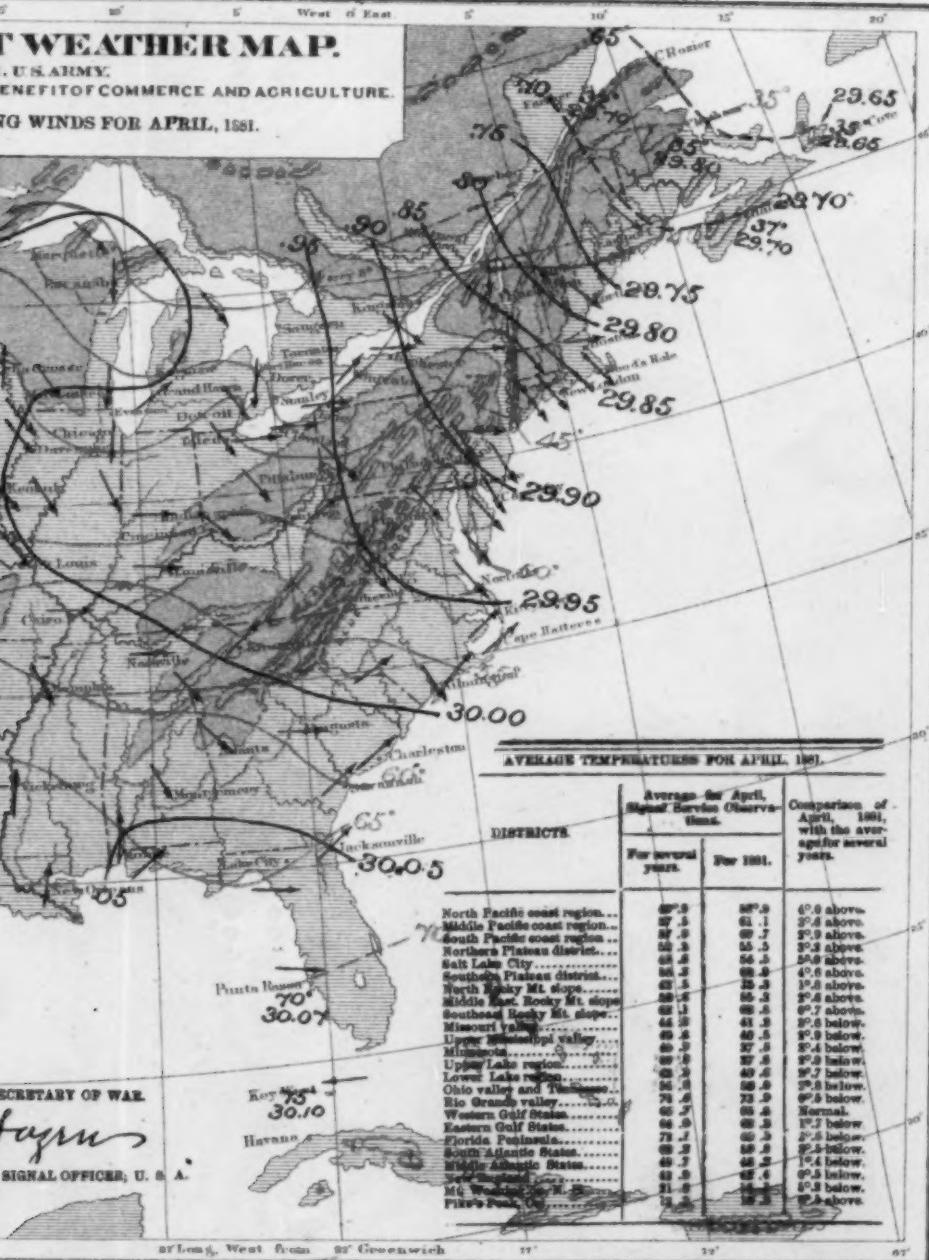
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ISOBARS, ISOTHERMS AND PREVAILING WINDS



No. II.



WAR DEPARTMENT W

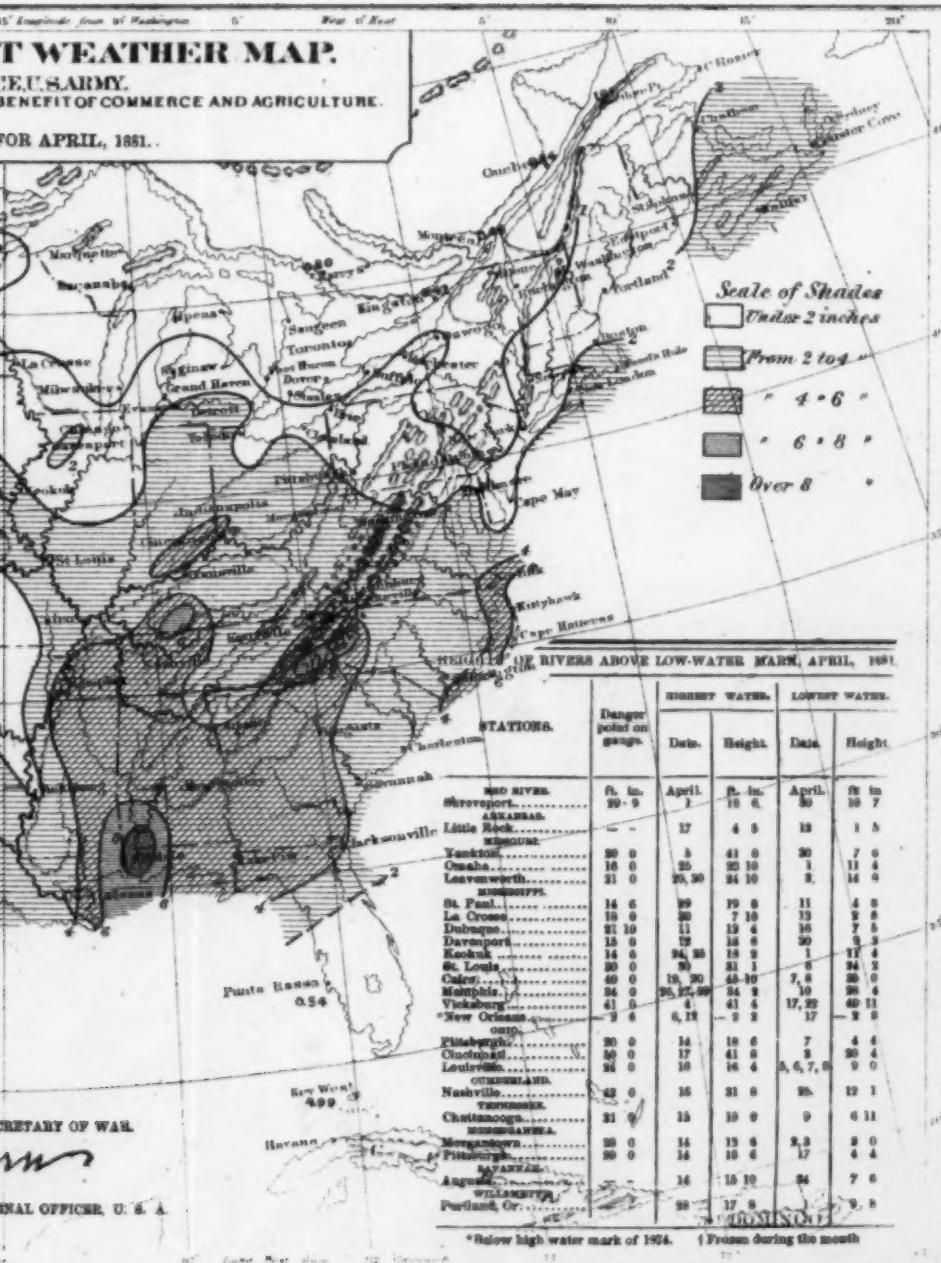
SIGNAL SERVICE, U.S.A.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT

PRECIPITATION CHART FOR APRIL



No. III.



Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charged from Actual Observations taken Simultaneously. Series commencing January, 1877.

No. V.





PREVAILING WINDS

ARROWS show the direction of, and fly with, the wind.
Force is shown as follows:

Symbol.	Fouc.	Velocity.		Metres per second.
		Miles per hour.	Metres per second.	
1.	2	0 to .9	0 to 4.0	
3.	4	0.1 to 22.5	4.1 to 10.1	
5.	6	22.6 to 40.5	10.1 to 18.1	
7.	8	40.6 to 67.5	18.1 to 30.2	
9.	10	67.6 up.	30.2 & over.	

CHIEF ENGINEER OFFICER 17
John G. Lloyd

PUBLISHED BY ORDER OF THE GOVERNOR OF MADRAS

ISOBARS AND ISOTHERMS.
Isobars in blue; detached barometer means
in English inches.
Isotherms in red; detached temperature

means in degrees Fahrenheit.
Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

mean sea level mean pressure, mean temperature, mean force and prevailing direction of wind in 31
7:35 A. M., Washington mean time, for the month of May, 1877, based

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Chartered from Actual Observations taken Simultaneously. Series commencing January, 1877.

No. VI.





PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

H. W. Stoyard

CHIEF SIGNAL OFFICER, U. S. A.
Storm-tracks in Black. The Arabic numerals show location
of the centres of Low Barometer, at 7:35 A. M., Washington
mean time, of that date.
Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for
MAY, 1879.